PHILIPS

16 Channel logic scope

PM3540

Operating manual

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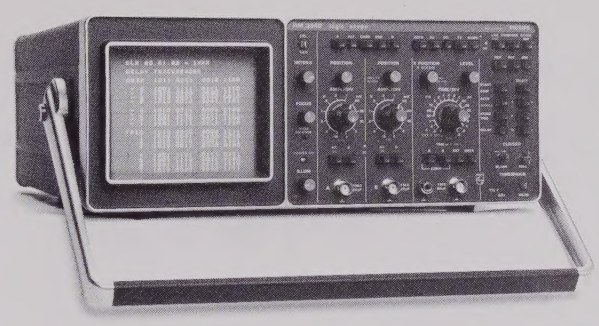

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IMPORTANT

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

WICHTIG

Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.

IMPORTANT

RECHANGE DES PIECES DETACHEES (Réparations)

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez TOUJOURS indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Note: *The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

Bemerkung: *Die Konstruktion und Schaltung dieses Geräts wird ständig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

Remarques: *Cet appreil est l'objet de développements et améliorations continuels. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

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1. General Information

1.1. INTRODUCTION

The PM 3540 logic-scope is a compact, portable instrument, featuring ergonomic design and extensive measurement capabilities. The logic-scope is a combination of a high-performance 16 channel logic state analyzer and a sophisticated 25 MHz dual-trace oscilloscope. Due to this combination, the instrument has the capability of testing all different types of computer-based systems, in both the data and timing domain.
In data domain the analyzer allows the user to monitor the software, as where the fault is located.
In timing domain the oscilloscope enables the user to indicate timing problems, as what causes the fault (hardware faults).
These analyzer-oscilloscope functions, combined in one stand-alone test-instrument makes it ideal for a wide range of use in research, development, production testing, throuble shooting, maintenance, field-service and educational applications.
A cathode-ray tube with a useful screen area calibrated into 8x10 divisions by an internal graticule, displays in the oscilloscope mode two well-defined traces. In the analyser mode, tabular data formats can be displayed in binary, octal or hexadecimal form.
A double-insulated power supply allows the frame ground to be directly connected to floating ground circuits provided this ground does not carry live potentials.

Interference by ground currents, as is frequently experiences with grounded instruments, is also substantially reduced.

Use of the logic-scope in the field is further facilitated by optional battery operation.

WARNING: The frame ground (and the probe's ground lead) must not be connected to live potentials.

Fig. 1.1. Logic-scope PM 3540

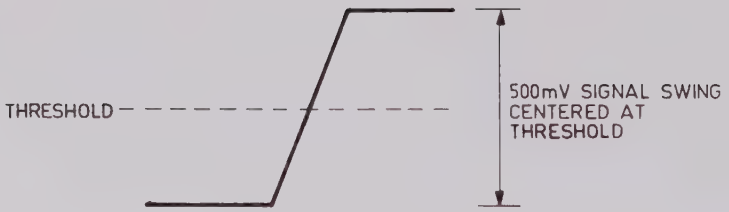


Fig. 1.2. Minimal signal swing

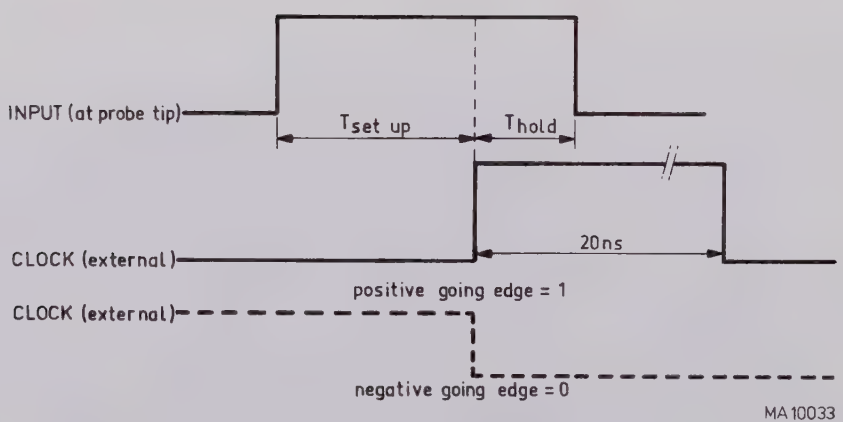


Fig. 1.3. Definition of set-up and hold times

1.2. CHARACTERISTICS

This instrument has been designed and tested according to IEC Publication 348 for Class II instruments and has been supplied in a safe condition. The present Instruction Manual contains information and warnings which shall be followed by the purchaser to ensure safe operation and to retain the instrument in a safe condition.

Properties expressed in numerical values with stated tolerances are guaranteed for ambient temperatures of +5 °C ... +40 °C unless stated otherwise. Numerical values without tolerances are typical and represent the characteristics of an average instrument. This specification is valid after the instrument has warmed up for 15 minutes.

OPERATION MODES : — Logic State Analyzer only
— Oscilloscope only
— Both Logic State Analyzer and Oscilloscope where L.A. triggers the scope.

NOTE : For operation and selection procedures about these modes, see Chapter 2 "DIRECTIONS FOR USE".

1.2.1. Characteristics of the analyzer part

1.2.1.1. Analyzer inputs : 3 Multi-lead input sockets providing:
— 16 data channels (via 2 sockets)
— 1 Clock
— 2 Clock qualifiers } (via 1 socket)

1.2.1.2. Data input

All values are typical values and specified at the probe tip(s)

: Via 3 multi-lead probe Pod's PM 8820 providing connections for 8 inputs each:
— Probe 1, channels 0 ... 7
— Probe 2, channels 8 ... 16
— Probe 3, clock and qualifiers

Impedance : 4 MΩ//6 pF

Max. Voltage : −50 V ... +50 V

Threshold : TTL, +1,4 V fixed
Variable: up to +10 V continuously adjustable via front panel measuring output socket.

Max. sensitivity : 500 mV p-p signal swing (see Fig. 1.2.).

Set-up and hold time: : Set-up time = 31 nsec.
Hold time = 2 nsec.,
with respect to the external active clock edge (see Fig. 1.3.).

1.2.1.3. Clock

Source : External (synchronous), input via probe Pod PM 8820.

Threshold : Same specification as data input

Clock rate : Max. 10 MHz.

Clockpulse width : Min. 20 nsec. (see Fig. 1.3.).

Sampling : Selectable on positive or negative clock edge.

1.2.1.4. Clock qualifier

Number : 3 clock qualifiers (input via multi-lead probe PM 8820).

Threshold : Same specification as data input.

Sampling : Only occurs when qualifier is "true" at clock edge.

"True" selection : "1" for high
"0" for low
"X" for don't care (qualifier not in use).

Set up and hold time : Set up time = 5 nsec.
Hold time = 2 nsec.,
with respect to the external active clock edge (see Fig. 1.3.).

1.2.1.5. Trigger

Source : Internal, external or manual

Internal : — By trigger word recognition on 16 channels.
— By trigger word recognition on 16 channels together with the trigger qualifier.
The trigger qualifier is input via the front panel BNC socket "EXTERNAL" in the QUAL mode.
Trigger qualifier input must be "true" at clock edge.
"True" is, when input signal is at or above threshold level.
Threshold has the same specification as data input.

External : Input via front panel BNC socket "EXTERNAL" in the QUAL mode.
Triggering only occurs, when trigger input is "true" at clock edge and trigger word is set at don't care (X ... X).
"True" is, when input signal is at or above threshold level. Threshold has the same specification as data input.

Manual : Via front panel START/STOP pushbutton switch.

Trigger word selection : — By specifying directly from the captured data with operating STORE TRIG pushbutton switch, contents of the first word of the displayed format will become new trigger word (see Fig. 2.5.).
— By selection via CRT display, cursor and controls 1/+, X and 0/- in the required formats (Hex, Oct, or Bin).

Triggering delay : Triggering can be delayed by 0 ... 9999 clock pulses controlled via CRT and selection pushbuttons + and —. Trigger delay on/off switching by pushbutton.

1.2.1.6. Start

Source : Automatic or manual

Automatic : The instrument starts itself automatically after a display time of approximately 1 second to allow pseudo real time observations.

Manual : Via front panel START/STOP pushbutton switch.

1.2.1.7. Memory : The memory format is 64x16 bit words.
In the compare mode a second memory of the same size is used.

1.2.1.8. Display (see also Fig. 2.5.) : — CRT of oscilloscope (see 1.2.2.1. for characteristisc).
— In the top part of the screen a continuous heading is given containing the parameters and the status of the instrument.
— Line number indication.
Trigger word is indicated as TRIG and is line number 0. All other lines are measured relatively to the trigger word.
Also in the delay mode.
— Cursor, horizontally and vertically positionable.
— Column blank and toll facilities.

Display modes : State table format in binary, hexadecimal or octal.
In binary the state table is displayed in 16 words of 16 bits. The 16 bits are divided in 4 groups of 4 bits.
In the hexadecimal and octal modes the state table and trigger word are regrouped.

1.2.2. Characteristics of the oscilloscope part

Including the combined analyzer/oscilloscope functions with the trigger sources:

- Y_A, Y_B, Composite and External (via oscilloscope)
- Data and Qual (via analyzer).

Designation	*Specification*	*Additional Information*
1.2.2.1. C.R.T.		
Type	D14-125 GH	Rectangular mesh-type
Measuring area	8x10 divisions	1 div. equals 1 cm with 2 mm sub-divisions along the central axes.
Screen type	P31 (GH)	P31 (GM) and P7 (GM) optional
Total acceleration voltage	10 kV	
Graticule	Internal	Cont. variable illumination
1.2.2.2. Vertical amplifier		
Display modes	Channel A only Channel B only A and B chopped A and B alternated A and B added	Chopped at approx. 500 kHz
Channel B polarity	Normal or inverted	
Response:		
Frequency range	DC: 0 ... 25 MHz (–3 dB) AC: 2 Hz ... 25 MHz (–3 dB)	
Rise time	⩽ 14 ns	
Pulse aberrations	⩽ ± 3 % (⩽ 4 % pp)	Measured at 8 div. amplitude and applied rise time of ⩾ 1 ns
Deflection coefficients	2 mV/DIV ... 10 V/DIV	1-2-5 sequence
Continuous control range	1 : ⩾ 2,5	uncalibrated
Deflection accuracy	± 3 %	
Input impedance	1 MΩ/20 pF	
Input RC time	0.1 s	Coupling switch to AC
Maximum permissible input voltage	400 V, d.c. + a.c. peak	
Vertical positioning range	16 divisions	
Dynamic range	24 divisions	
Visible signal delay	⩾ 40 ns	
C.M.R.R. in A-B mode	⩾ 40 dB at 1 MHz	After adjustment at d.c. or low frequencies
Cross talk between channels	–40 dB or better at 10 MHz	
Instability of the spot position:		
Temperature drift	⩽ 0,3 div/hour	
1.2.2.3. Time base		
Time coefficients	0.5 s/DIV ... 0.2 μs/DIV	1-2-5 sequence
Continuous control range	1 : ⩾ 2,5	uncalibrated
Coefficient error	± 3 %	
Magnification	10x	
Magnifier error	± 2 %	

Designation	*Specification*	*Additional information*
1.2.2.4. Triggering		
Source	External Internal Internal + External	via front panel input socket triggering – triggering via oscilloscope – triggering via analyzer – triggering via analyzer and front panel input socket "EXTERNAL"
Triggering via oscilloscope	Y_A, Y_B and Composite	COMP is A and B depressed
Triggering via analyzer	At trigger word	DATA depressed
Triggering via analyzer + External	At trigger word and trigger qualifier	in QUAL mode (i.e. EXT and DATA depressed) and trigger qualifier is "true". "True" is at high level.
Trigger mode	Automatic, normal AC normal DC and TV	TV line or frame switched by TIME/DIV switch. TV line : .2 µs/div ... 20 µs/div TV frame: 50 µs/div ... 5 s/div.
Trigger sensitivity	Internal: 1.0 div. at 25 MHz or word triggering External: 0.5 Vpp at 25 MHz TV int.: 0.7 div. TV ext.: 0.35 Vpp	 Sync. pulse amplitude Sync. pulse amplitude
Triggering frequency range	AUTO: 20 Hz ... ⩾ 25 MHz AC: 5 Hz ... ⩾ 25 MHz DC: 0 Hz ... ⩾ 25 MHz	Typically, stable triggering can still be obtained at 50 MHz and 2 div. or 1 Vpp amplitude
Level range	AUTO: Proportional to peak-to peak value of trigger signal. AC, DC: 16 div. at internal trigg. and 8 V at external trigg.	 + or –8 div and + or –4 V referenced to centre of screen.
Triggering slope	Positive or negative going	
Input impedance (External socket)	1 MΩ//20 pF	
Maximum permissible input voltage (External socket)	400 V d.c. + a.c. peak	
1.2.2.5. X Deflection		
Source	A, B or EXT.	As selected by trigger source switch, if TIME/DIV switch is in pos. X DEFL.
Deflection coefficients	A or B: as selected by switch AMPL/DIV. EXTERNAL: 0.5 V/division	
Deflection accuracy	± 10 % in A or B	
Frequency range	DC: 0 ... 1 MHz (–3 dB) AC: 5 Hz ... 1 MHz (–3 dB)	
Phase shift	⩽ 3° at 100 kHz	
Dynamic range	24 divisions	For frequencies ⩽ 100 kHz

Designation	*Specification*	*Additional Information*
1.2.2.6. Calibration generator		
Output voltage	1.2 Vpp	Square wave
Accuracy	± 1 %	
Frequency	≈ 2 kHz	

1.2.3. Characteristics of the power supply

Designation	*Specification*	*Additional Information*
AC supply:	Double insulated	Safety Class II, IEC 348
Nominal voltage range (on line-mains voltage adaptor)	110, 127, 220 or 240 Va.c. ± 10 %	
Nominal frequency range	46 ... 440 Hz ± 10 %	
Power consumption	40 W max.	At nominal mains voltage
DC supply:		
Voltage range	22-27 Vd.c. 20-28 V	Floating input With relaxed specifications
Current consumption	1.1 A max.	
Capacity to earth	110 pF	Measured with rubber feet on earthed metal plate of 1 m^2
	23 pF	Measured 30 cm above earthed plate of 1 m^2

1.2.4. Environmental characteristics

The environmental data are valid only if the instrument is checked in accordance with the official checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS organisation in your country, or by N.V. PHILIPS' GLOEILAMPENFABRIEKEN, TEST AND MEASURING DEPARTMENT, EINDHOVEN, THE NETHERLANDS.

Ambient temperature		
Rated range of use	+5 °C ... +40 °C	
Limits of operation	−10 °C ... +55 °C	
Storage and transport conditions	−40 °C ... +70 °C	
Humidity	According to IEC 68 Db	
Bump	1000 bumps of 10 g, ½ sine, 6 ms duration in each of 3 directions	
Vibration	30 minutes in each of three directions, 10-150 Hz; 0.7 mm p-p and 5 g max. acceleration	
Altitude		
Limit of operation	5000 m (in open air)	is 475 mbar or 47,5 kPa
Limit of transport	15000 m (in open air)	is 100 mbar or 10,0 kPa
Recovery time	30 minutes if instrument temperature is raised from −10 °C to +20 °C at 60 % relative humidity	

Electromagnetic interference meets VDE Störgrad K.

Designation	*Specification*	*Additional Information*
1.2.5. Mechanical data		
Dimensions:		
Length	445 mm	Handle and controls excluded
Width	330 mm	Handle excluded
Height	150 mm	Feet excluded
Weight	8 kg (176 lb)	

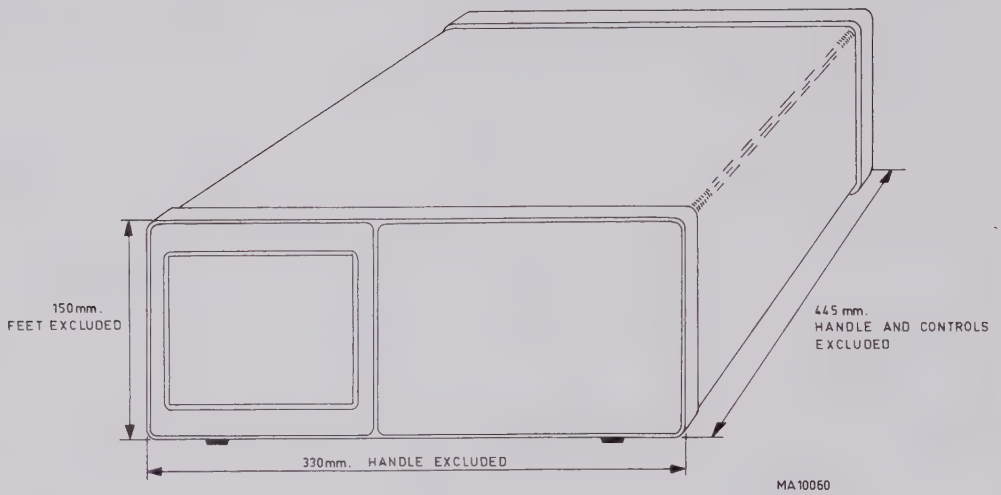


Fig. 1.4. Dimensions

1.3. ACCESSORIES

1.3.1. Supplied with the instrument

Front cover
1 BNC 4 mm adaptor
2 Probes PM 9336
Instruction manual
3 Multi-lead probe POD's

1.3.2. Optional (see also section 3 "INFORMATION CONCERNING ACCESSORIES")

Analyzer probes:	Multi-lead probe PM 8820	
	Extension kit PM 8819	
	Qualifier extension probe PM 8810	
Oscilloscope probes:	Passive probe 1:1	PM 9335 (L)
	Passive probe 10:1	PM 9336 (L), PM 9350 (L), or PM 9351 (L)
	Passive probe 100:1	PM 9358
	Miniature Fet probe	PM 9352
	Fet probe	PM 9353
	Current probe	PM 9355
	Probe power supply	PM 9346
Sundries:	Oscilloscope trolley	PM 8991
	Polaroid filter	PM 8910
	Viewing hood	PM 9366
	Long viewing hood	PM 8980
	Oscilloscope camera	PM 9380
	Adaptor for PM 9380	PM 8971
	19-in rackmount	PM 8963
	Accessory pouch	PM 8992
	Banana-BNC adapter	PM 9051

2. Directions for use

2.1. GENERAL INFORMATION

This section outlines the procedures and precautions necessary for installing the PM 3540, identifies and briefly describes the functions of the front and rear panel controls and indicators, and explains the practical aspects of operation to enable an operator to evaluate quickly the instrument's main functions.

2.1.1. **Safety regulations** (in accordance with IEC 348)

Before connecting the instrument to the mains (line), visually check the cabinet, controls and connectors, etc. to ascertain whether any damage has occured in transit. If any defects are apparent, do not connect the instrument to the mains (line).

The instrument must be disconnected from all voltage sources, and any high voltage points discharged before any maintenance or repair work is carried out. If adjustments or maintenance of the operating instrument with covers removed is inevitable, it must be carried out only by a skilled person who is aware of the hazards involved. In normal operation the double-insulated power supply obviates the need of a safety ground.
Bear in mind that the capacitors inside the instrument may still be charged even if the instrument has been separated from all voltage sources.
Never remove a circuit board until the oscilloscope has been swirched off for at least one minute.
When an instrument is brought from a cold to a warm environment, condensation may cause a hazardous condition. In this situation, you must allow approximately 30 minutes (i.e. recovery time, see 1.2.4. "Environmental characteristics") for your oscilloscope to acclimatize until all condensation has evaporated.

Warning:	**It must be borne in mind that in all measurements the frame ground of the instrument is raised to the same potential as that of the measuring ground probe connections. Neither the probe's ground lead nor the frame ground shall be connected to live potentials.**

2.1.2. **Installation, Mains adaption and connection**

Before connecting the instrument to the mains (line), make sure that it is set to the local mains (line) voltage. On delivery the instrument is set to 220 V. If the instrument is to be used with 110 V, 127 V or 240 V supply, the appropriate voltage should be selected by turning the adaptor on the rear panel to indicate the voltage required (see Fig. 2.1.).

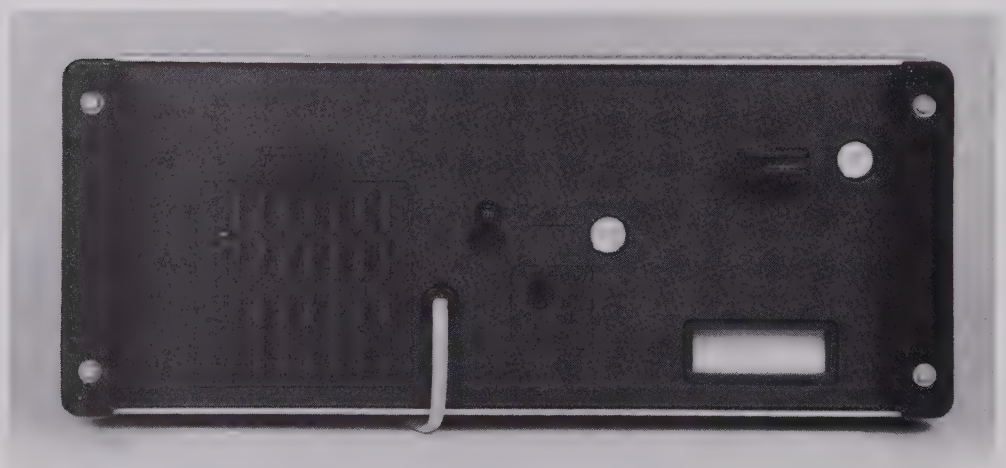


Fig. 2.1. Rear view of the logic-scope showing the voltage adapter

2.1.3. Fuse

The instrument is protected from overloads by a thermal fuse fitted between the mains (line) transformer windings. It can be replaced after having removed the instrument rear panel (see section 2.8.).
Only the fuses prescribed must be used.

2.1.4. Connection to an external supply

An external supply or battery of 22 V to 27 V capable of delivering at least 2 A can be connected to the socket on the rear panel (DC power input cord set: 4822 321 20125).

The inner conductor must be connected to the negative pole and the outer conductor to the positive pole, as indicated on the rear panel.

The instrument is protected against overloads and wrong polarity by an internal fuse and diode. This fuse can be replaced after having removed the instrument rear panel (see section 2.8.).

2.1.5. Front cover and instrument position

The front cover can be simply removed by pulling it from the front.
The instrument may be used horizontally or in several sloping positions by using the carrying handle as a tilting bracket.

2.1.6. Carrying handle

The handle can be rotated if the pushbuttons on its bearings are depressed.

2.1.7. Switching on

The POWER switch is incorporated in the graticule ILLUM control on the front panel, immediately beside the screen bezel. The associated POWER ON/OFF indicator lamp is adjacent to the ILLUM control.
The oscilloscope must never be switched on whilst any circuit board is removed.

2.1.8. Cooling

Take care that the natural air flow through the instrument is not obstructed.
Do not position the instrument on any surface which produces or radiates heat.
Do not place any instruments or papers on top of the instrument to avoid excessive heating-up.

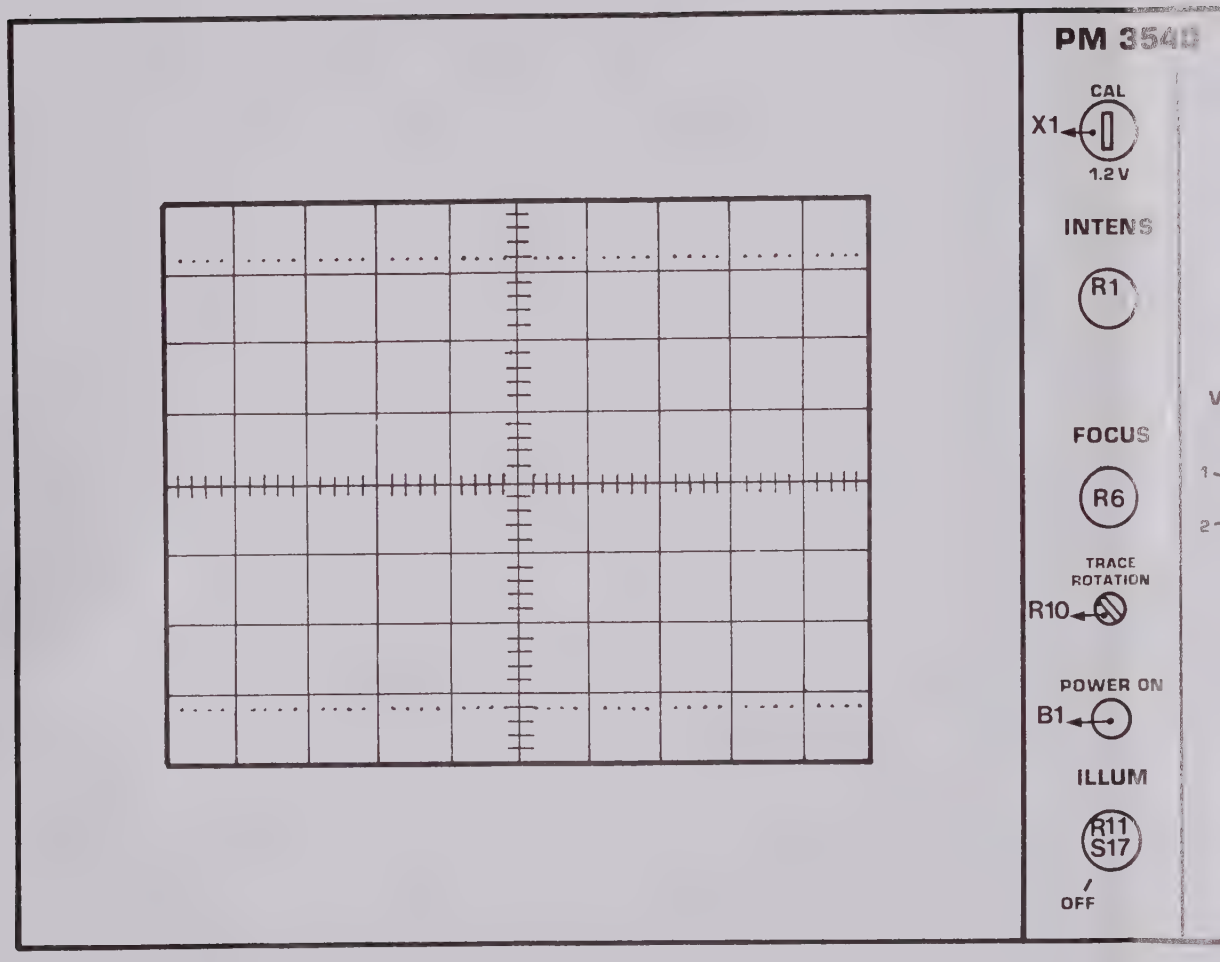
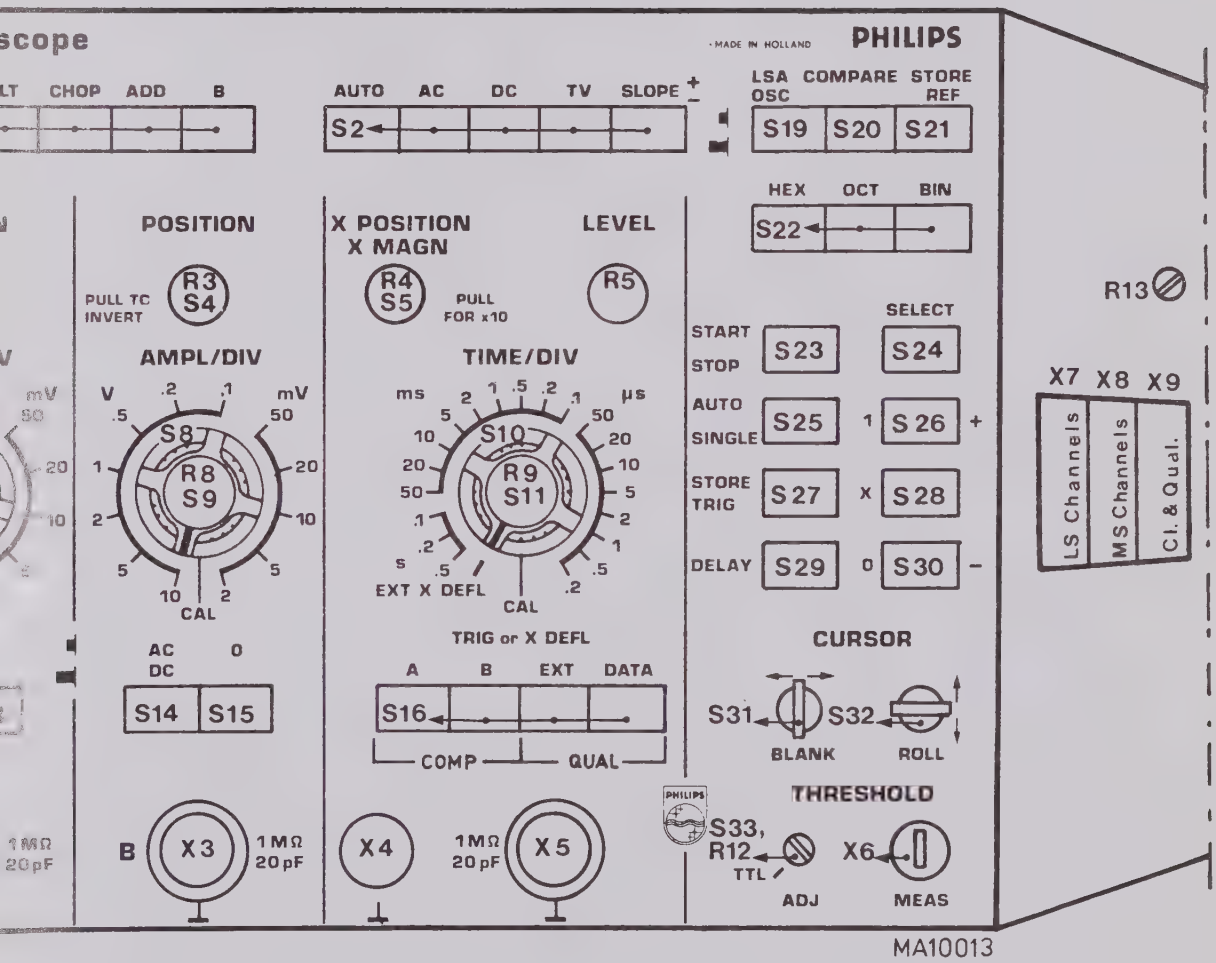


Fig. 2.2. Front view showing controls and sockets


scope
MADE IN HOLLAND
PHILIPS
LT
CHOP
ADD
B
AUTO
AC
DC
TV
SLOPE
S2
LSA OSC
COMPARE
STORE REF
S19
S20
S21
HEX
OCT
BIN
S22
POSITION
PULL TC INVERT
R3
S4
X POSITION
X MAGN
R4
S5
PULL FOR x10
LEVEL
R5
R13
SELECT
START
STOP
S23
S24
AMPL/DIV
V
mV
S8
R8
S9
TIME/DIV
ms
µs
S10
R9
S11
EXT X DEFL
CAL
AUTO
SINGLE
S25
S26
STORE TRIG
S27
S28
DELAY
S29
S30
X7
X8
X9
LS Channels
MS Channels
CI. & Qual.
AC
DC
0
S14
S15
TRIG or X DEFL
A
B
EXT
DATA
S16
COMP
QUAL
CURSOR
S31
S32
BLANK
ROLL
THRESHOLD
S33,
R12
TTL
ADJ
X6
MEAS
B
X3
1MΩ
20pF
X4
1MΩ
20pF
X5

MA10013

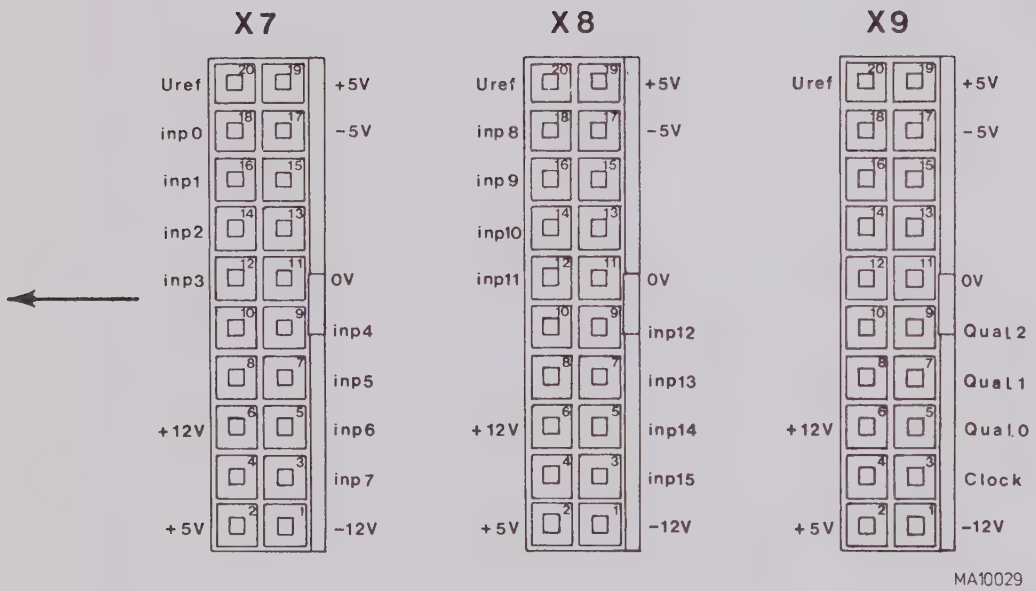


Fig. 2.2.1. Data input sockets (front view)

2.2. CONTROLS AND SOCKETS (refer to Fig. 2.2.)

2.2.1. Controls and sockets of the analyzer part

2.2.1.1. Mode

Function selection switch LSA (depressed) OSC (released)	2-way pushbutton switch Analyzer mode is selected Oscilloscope mode is selected.
COMPARE pushbutton	The captured data block is compared with the reference data block.
STORE REF pushbutton	Data is transferred from input memory into reference memory.

2.2.1.2. Display

Hex pushbutton	Selecting the state table in hexadecimal format
OCT. pushbutton	Selecting the state table in octal format
BIN pushbutton	Selecting the state table in binary format.
BLANK tumbler switch S31 (pushbutton SELECT released)	"Right" position: data presentation channels are blanked starting at channel 15 as long as this position is activated. "Left" position: blanked channels are displayed again in reversed direction as "Right" position.
CURSOR tumbler switch S31 (pushbutton SELECT depressed) Cursor is an intensified digit in the heading of the display	This mode provides cursor shift for parameter selection. "Right" position: direction of the cursor is to the right "Left" position: direction of the cursor is to the left.
ROLL tumbler switch S32 (pushbutton SELECT released)	"Upper" position: displayed format rolls upwards through the 64 words memory "Lower" position: displayed format rolls downwards through the 64 words memory.
CURSOR tumbler switch S32 (pushbutton SELECT depressed) Cursor is an intensified digit in the heading of the display.	This mode provides cursor shift for parameter selection. "Upper" position: the cursor moves upwards "Lower" position: the cursor moves downwards.
SELECT pushbutton (parameter selection)	To specify the clock edge, clock qualifiers, trigger word and delay. The status of the parameters are given in the heading of the display.
Selection pushbuttons "1" function	Setting the parameters. "1" pushbutton selects "true" for a high level or positive going clockedge.
"0" function	"0" pushbutton selects "true" for a low level or negative going clockedge.
"X" function	"X" pushbutton selects don't care.
"+" function "–" function	Add function: 0 ... 9 $_{DEC.}$, 0 ... F$_{HEX.}$ and 0 ... 7$_{OCT.}$ Subtract function: 9 ... 0$_{DEC.}$, F ... 0$_{HEX.}$ and 7 ... 0$_{OCT.}$
DELAY pushbutton	Activates the trigger delay. Pushbuttons "+" and "–" set the value of the trigger delay. "+" counts up to 9999 "–" counts down.
STORE TRIG pushbutton	After depressing this pushbutton, the contents of the top row (i.e. the 1st word) of the displayed format becomes automatically the new trigger word.

2.2.1.3. START

START/STOP pushbutton	Single position pushbutton with two functions: – first push operation starts data acquisition – second push operation stops data acquisition
Acquisition mode switch SINGLE (released) AUTO (depressed)	2-way pushbutton switch. Data is captured in a single sample Data is captured in automatically repeated samples.

2.2.1.4. THRESHOLD

ADJ/TTL (R12/S33)	Screwdriver adjustment for variable threshold. Variable from 0 V up to +10 V. TTL threshold voltage of +1,4 V, fixed.
MEAS.	Output socket supplying the fixed +1.4 V TTL voltage or the adjusted threshold voltage.

2.2.1.5. Miscellaneous

Y-POSITION (R13) Screwdriver adjustment	Continuously variable control giving vertical shift of the display in the analyzer mode.
Input X5 ("EXTERNAL")	BNC socket, input for trigger qualifier or trigger signal. See also section 2.2.2.4.
Input X7	Multi-lead connector to provide input for the 8 least significant channels.
Input X8	Multi-lead connector to provide input for the 8 most significant channels.
Input X9	Multi-lead connector to provide input for the clock and the clock qualifier signal.

2.2.2. Controls and sockets of the oscilloscope part
(Including the combined analyzer/oscilloscope functions)

2.2.2.1. Mode

Function selection switch OSC (released) LSA (depressed)	2-way pushbutton switch Oscilloscope mode is selected Analyzer mode is selected.

2.2.2.2. Vertical channels

Display mode switch	Function
	5-way pushbutton switch selecting the vertical display mode. With all buttons released, the ALT mode is in operation.
A	Vertical deflection is achieved by the signal connected to input of channel A.
ALT	The display is switched over from one vertical channel to the other at the end of every cycle of the time-base signal.
CHOP	The display is switched over from one vertical channel to the other at a fixed frequency ($f \approx 500$ kHz).
ADD	Vertical deflection is achieved by the sum signal of channels A and B (or –B).
B	Vertical deflection is achieved by the signal connected to the input of channel B.

POSITION	Continuously variable controls giving vertical shift of the display.
PULL TO INVERT B	Push-pull switch combined with the channel B POSITION control. When pulled, channel B signal is inverted.
AMPL/DIV (outer knob)	Step control of the vertical deflection coefficients, ranging from 2 mV/div up to 10 V/div in a 1-2-5 sequence.
AMPL/DIV (centre-knob)	Continuously variable control of the vertical deflection coefficients. Note that the deflection coefficient is calibrated only with the centre-knob switched to the CAL position (fully-clockwise).
Input coupling switch	Signal coupling; 2-way pushbutton switch.
AC (depressed)	Coupling via a blocking capacitor
DC (released)	Direct coupling
0 (depressed)	Connection between input circuit and input socket is interrupted and the input circuit is grounded.
Y_A	BNC socket for channel A input
Y_B	BNC socket for channel B input

2.2.2.3. Triggering

Trigger mode switch	Function
	5-way pushbutton switch, selecting the trigger mode and the polarity of the trigger transition. With all pushbuttons released AUTO sweep mode is in operation at a fixed range of the LEVEL control.
AUTO	A trace is displayed in the absence of trigger signals. The range of the LEVEL control is proportional to the peak-to-peak value of the triggering signal.
AC	Normal triggering and fixed range of the LEVEL control. DC component of trigger signal is passed.
TV	Line or frame synchronisation is obtained as dicated by TIME/DIV switch (frame from .5 s/div to 50 µs/div and line from 20 µs/div to .2 µs/div).
+/–	Sweeps are triggered on positive or negative-going trigger signal transitions. In TV, – must be selected for negative video signals and + for positive video signals.
LEVEL	Control for continuously varying the level of the waveform on which the display is to start.
TRIG OR X DEFL	See TRIG or X DEFL source switch in section 2.2.2.4. below.

2.2.2.4. Horizontal channel

TRIG or X DEFL source switch	Function
	4-way pushbutton switch selects the trigger source or the source of horizontal deflection if the TIME/DIV switch is the X DEFL position. With all pushbutton released source A is selected.
A	Signal derived from channel A.
B	Signal derived from channel B.

COMP (A & B both depressed; inoperative with X DEFL)	Signal derived after the electronic channel switch. Triggering occurs on the waveforms as presented on screen.
EXT	Triggering or X-deflection on signal derived from a voltage applied to the input socket X5 ("EXTERNAL").
DATA	Internal triggering on signal derived from captured data when trigger-word is recognized.
QUAL (EXT & DATA both depressed)	Internal triggering on signal derived from captured data when trigger-word is recognized, conditioned with a trigger qualifier signal applied to the input socket X5 ("EXTERNAL").
X POSITION X MAGN	Continuously variable control giving horizontal shift of the display; incorporates a push-pull switch which increases the horizontal deflection by a factor of 10.
TIME/DIV (outer part)	Selects the time coefficient from .2 μs/div to .5 s/div in a 1-2-5 sequence Dictates line or frame triggering in TV mode. In position X DEFL horizontal deflection is determined by TRIG or X DEFL switch.
TIME/DIV (centre knob)	Continuously variable control of the time coefficients. Must be in CAL position (i.e. fully clockwise) for the time axis to be calibrated according to the indication of the TIME/DIV switch.
Input X5 ("EXTERNAL")	BNC socket: Input for external trigger or horizontal deflection signal. Input for trigger amplifier signal.

2.2.2.5. Miscellaneous

CAL	Output socket supplying a squarewave of $\approx$ 2 kHz and an amplitude of 1.2. $V_{p\text{-}p} \pm$ 1 %. To be used for probe compensation and/or checking vertical deflection accuracy.
External supply	Input socket at the rear of the instrument allows the instrument to be operated by an external d.c. supply. Rated supply voltage 22 V to 27 V, current capability $>$ 1,1 A.
LINE (MAINS) VOLTAGE ADAPTOR	Must be set according to section 2.1.2. before the instrument is connected to the local mains voltage.

2.2.3. Cathode-ray tibe and POWER controls

ILLUM POWER ON	Continuously variable control of the graticule illumination; incorporates mains (line) switch. Pilot lamp indicates the ON state.
INTENS	Continuously variable control of the trace brilliance.
FOCUS	Allows beam to be focussed for minimum spot size.
TRACE ROTATION	Screwdriver adjustment to align the trace with the horizontal graticule lines.

2.3. OPERATING INSTRUCTIONS

2.3.1. Switching on the instrument

Before connecting the instrument to any supply, the instructions given in section 2.1. Installation, should be carefully carried out.
The instrument will meet specifications (see section 1.2.) normally after a warming-up period of approximately 15 minutes. However, if the instrument has been subjected to an extremely cold environment (e.g. left in a car overnight in freezing conditions) and is then brought in for use in a warm room, a warming-up period of sufficient length should be allowed (see 1.2.4.).

2.3.2. Preliminary procedure

This procedure is a general indication of whether the instrument is functioning correctly and provides a suitable starting point before any measurement are made.
Refer to Fig. 2.2. for location of controls.
Set INTENS and FOCUS controls in mid position.
Depress both "0" pushbuttons.
Depress AUTO and select an average time coefficient between 10 μs/div and 10 ms/div with the TIME/DIV switch. With all other pushbuttons normal (not depressed) channel A and channel B traces can be positioned on the screen with the relevant POSITION controls. Set the INTENS control for a display of medium brightness and adjust FOCUS control for well focussed traces.

2.3.3. Power-on test

When switching-on, the microprocessor initiates a test program to check the immediate microprocessor environment.
If this test gives a faulty result the c.r.t. of the instrument remains dark.

2.3.4. Service test

The instrument is provided with a test program to pin-point any functional defect.
This program is selected by pressing STORE TRIG and STORE REF pushbuttons simultaneously and pushing the START/STOP pushbutton twice.
More information about the "service test" will be given in the SERVICE MANUAL of this instrument.

2.4. LOGIC STATE ANALYZER MODE

With the PM 3540 in this mode, the user can examine the software instructions given in the same way as they were designed. For example:

- displays can be made in binary, octal or hexadecimal to suit the individual application.
- the display of 16 serial bits x up to 16 parallel channels (i.e. display window) can be paged through the captured data block of 64x16 bits.
- the captured data block can be shifted easily up- and downstream relative to a pre-selected word (trigger-word) in the data stream.
- a reference block of data can be compared with a second block of captured data, in order to quickly and conveniently locate a fault.
- the instrument can then be set to trigger on the fault or in the vicinity of the fault.

With all these facilities, the user can make a detailed and meaningsful analysis of any digital problem.

2.4.1. Data acquisition

Data acquisition is the process by which digital signals are sampled and converted into binary form.
For convertion into binary form, see "THRESHOLD" section.
The data which have to be displayed must be applied to the right side panel inputs (X7, X8 and X9) via the appropriate PM 8820 probe Pod's (for characteristics concerning this probe Pod, see Chapter 3.). Note that unused inputs of the probe automatically result in zero level signals (refer also the "Channel blanking" section 2.5.4.).

2.4.2. Threshold level

To achieve proper data acquisition, the logical binary state of the incoming data, has to be converted into proper binary pulses.
To do this, the threshold voltage must be set correctly.
This is automatically done for the TTL level; also a variable threshold (ADJ.) has been built-in.
To set the threshold value in the ADJ mode, connect a voltmeter to the output socket MEAS and adjust the corresponding potentiometer (screwdriver adjustment).
Note that the threshold value only apply if the PM 8820 probes are used and that the threshold value can not be selected for inputs X7 (least sign. channels), X8 (most sign. channels) and X9 (clock & qualifiers) separately.
Correct earth connection of each probe POD is strongly recommended.

2.4.3. Clock

The clock is a repetitive signal, which determines the frequency of samples taken from the applied measuring signals. At each clock pulse, a sample of the applied signals is taken and stored in the input memory of the PM 3540.
The above action is started by the START function and stopped by the STOP function of the START/STOP pushbutton.

The clock signal is derived from the clock (or other signal) present in the instrument which must be tested. This is called a synchronous clock, because the analyzer's sample actions is run in synchronization with the system under test. The clock action can be selected at the positive or negative going edge of the system clock.

2.4.4. Clock qualifier

The clock qualifier allows more selective data acquisition by gating the clock with an additional condition which can be "1", "0" or "X" (don't care), selectable with the selection pushbuttons 1, X or 0.

2.4.5. Triggering (see Chapter 1.2. for characteristics)

The trigger action stops data acquisition and storage, the input memory holds the data stored before the trigger was received.
The memory contents is available to be displayed (this text is valid without TRIGGER DELAY).

As trigger source can be choosen:

- a certain selected word occuring in the input data stream (i.e. internal triggering)
- an externally applied signal
- manual.

2.4.5.1. Internal triggering

Triggering takes place when the analyzer recognises a match between a word in the data stream and a certain pre-selected trigger word.
This trigger word consists of a combination of logic "1" and "0" 's, which can be selected by means of the selection pushbuttons or from the display with the aid of the pushbutton "STORE TRIG". Input channels which are not used, or of which the bit information is not important, the X-function (don't care) has to be selected.
Internal triggering can be combined with trigger delay and trigger qualifier.

2.4.5.2. External triggering

Triggering takes place by an external signal, applied to the front panel BNC socket "EXTERNAL". Triggering only occurs, when the trigger input is "true" at the clock edge and the triggerword consist of don't care (X ... X).
External triggering can be combined with trigger delay.

2.4.5.3. Manual triggering

Triggering takes place by pushing the START/STOP button when the message "NOT TRIGGERED" has been displayed; this overrules all other trigger conditions (the trigger delay as well). Manual triggering is useful to display captured data, even if the triggerword is unknown or unfindable. Manual triggering can be combined with trigger delay.

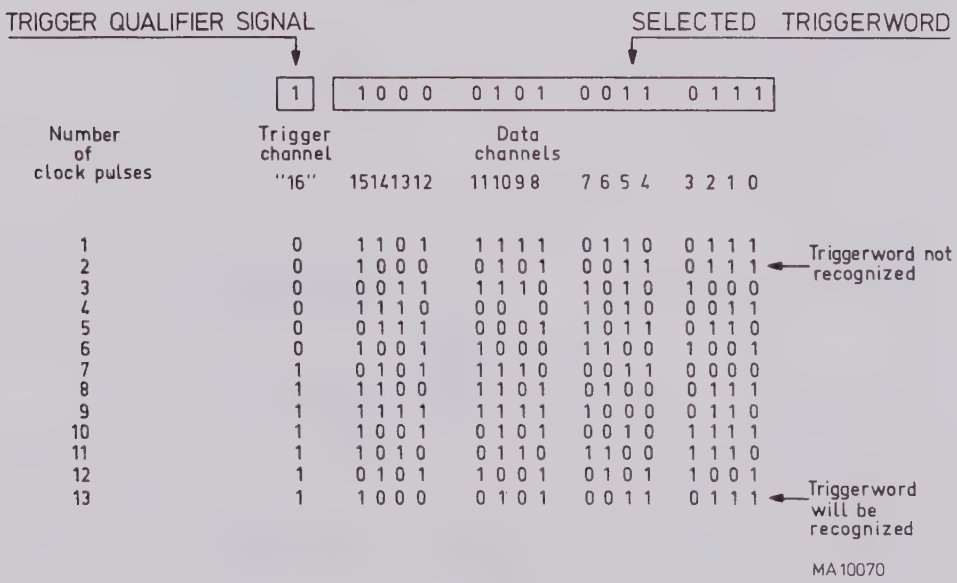


Fig. 2.3. Triggerword plus trigger qualifier

2.4.6. Trigger qualifier

The trigger qualifier is meant as an extra conditional signal for the selected internal triggerword. The trigger qualifier signal is input via the front panel BNC socket "EXTERNAL" and is effective in the "QUAL" mode.

The trigger qualifier allows more selective data acquisition by gating the trigger signal with an additional condition which can be seen as a 17th channel for trigger recognition (see Fig. 2.3.).
This input has the same specification as the data inputs and is "true" at high level.
Connecting the trigger extension probe PM 8810 to this input, the trigger selection capacity can be extended.

2.4.7. Trigger delay

By pushing the "DELAY" button the trigger delay is switched on. The trigger delay is a number of clock pulses, elapsing between appearance of the trigger word or external trigger signal, and the actual moment of triggering. This means that the data block to be measured can be positioned downwards in the data stream (see Fig. 2.4.).

Post triggering

Using the trigger delay, virtually any data block downstream from the initial triggerword (or trigger signal) can be selected.
The trigger delay value can be selected between 0 and 9999 system clock pulses and is shown in the heading of the display. When for example the trigger delay is set to 63, the complete memory contents is refreshed with data which appeared just after the trigger-word (or trigger signal), see Fig. 2.4.).

Pre-triggering

If the trigger delay is switched-off (reset the "DELAY" button) or the trigger delay has been set to 0, triggering takes place, at the same moment that the triggerword is present on the data inputs. In this case the memory contains, 63 data words, which are captured just before the trigger word (or trigger signal) see Fig. 2.4.
This mode is indicated by a minus character in the display.

Centre triggering

This is, when the triggerword is brought into the centre of the captured data block.
For this, a trigger delay of 32 clock pulses has to be selected (see Fig. 2.5.).

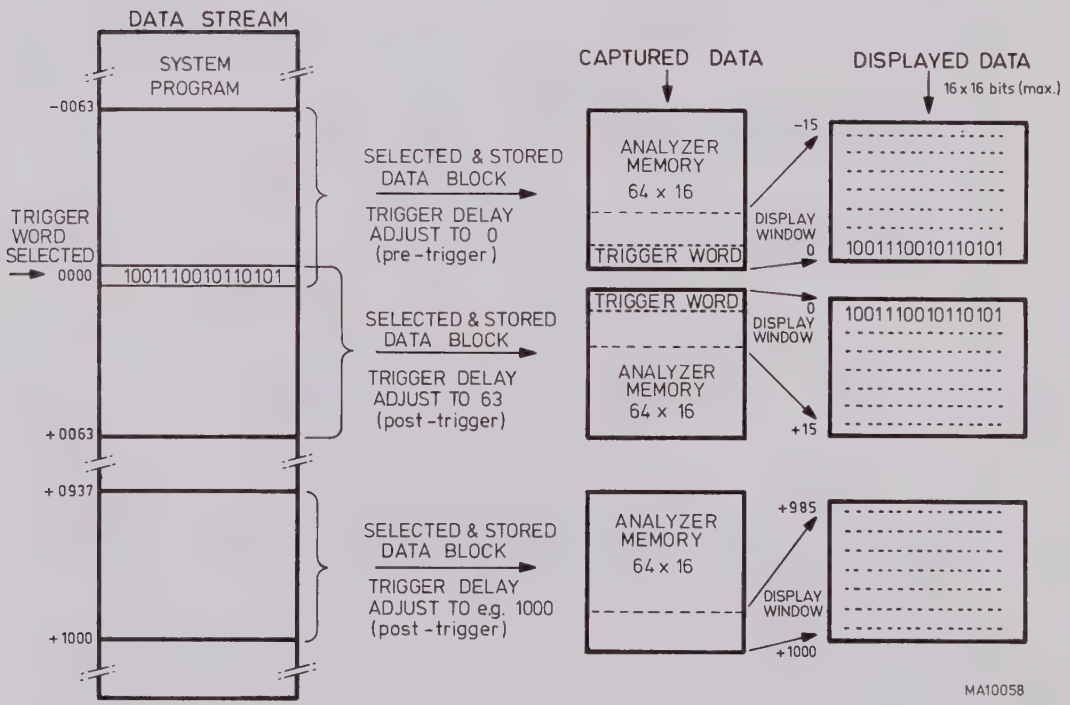


Fig. 2.4. Relationship between trigger delay, memory and display

2.4.8. **Display** (see Fig. 2.5.)

In the analyzer mode the display exhibits data on the oscilloscope CRT in a thruth table-type format.
The data can be shown in binary, octal or hexadecimal form.
The continuously displayed heading in the top part of the screen contains information about the parameters and the status of the instrument.
Line indication are memory addresses and related to the triggerword so that the position of the displayed detail (i.e. display window) is known at all times).

2.4.8.1. Paging

As illustrated in Fig. 2.5. the actual display on the screen is a 16 word data block (i.e. display window) within the total captured data block.
In order to display the rest of the captured data the "roll" facility of the cursor control is used, which allows the user to page through the entire 64 word data block.

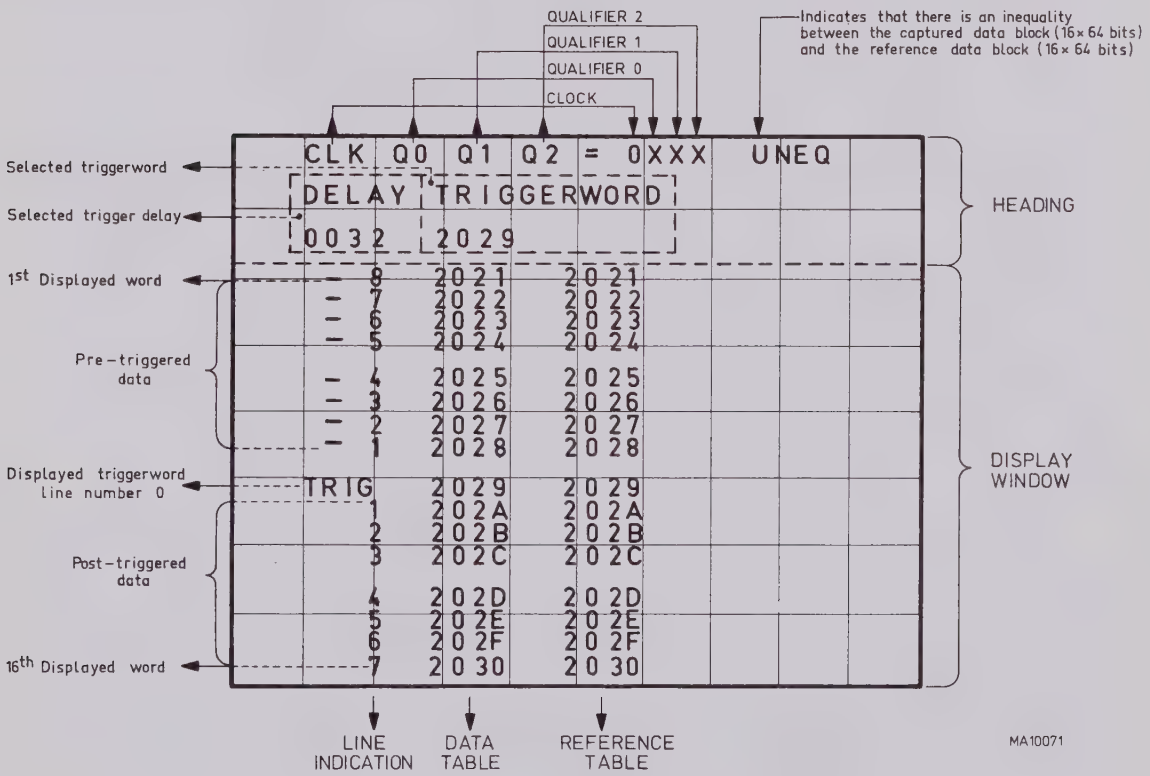


Fig. 2.5. Display

2.5. SELECTION OF THE LOGIC STATE ANALYZER MODE

By depressing pushbutton LSA/OSC the analyzer mode is selected and the input signals which have to be displayed are simultaneously clocked into an input memory at a sample clock transition with respect to the selected threshold level.
The format of the input memory is 64x16 bit words.

2.5.1. Parameter selection mode

With pushbutton SELECT depressed the instrument is in the selection mode.
Before logic analysis can be made, the triggerword, clock edge, clock qualifiers and possible trigger delay must be selected. To do this the parameters can be specified by use of the horizontal cursor control, the vertical cursor control and the selection pushbuttons 1/+, X (don't care) and 0/–.
These selection pushbuttons can be used step by step or continuously.

2.5.2. Selection pushbuttons

The selection buttons enable the user to specify the parameters in the heading and represent different functions dependable on the various parameters and the display mode.

"1, +" : Pushbutton with automatic release.

- function "1" : logical one for
  - – trigger word in BIN format
  - – qualifier
- function "+" : add function for
  - – delay in 0-9 cycle
  - – trigger word in the case of: HEX format in 0-F cycle; OCT format in 0-7 cycle

"X" : Pushbutton with automatic release.

- function "X" : don't care for
  - – trigger word in BIN format
  - – qualifier

"0, –" : Pushbutton with automatic release.

- function "0" : logical zero for
  - – trigger word in BIN format
  - – qualifier
- function "–" : subtract function for
  - – delay in 9-0 cycle
  - – trigger word in the case of: HEX format in F-0 cycle; OCT format in 7-0 cycle.

2.5.3. Cursor and CURSOR controls

In the select mode (i.e. pushbutton SELECT depressed) the cursor is identified by an intensified digit in the heading of the display and is positioned by the cursor controls in horizontal or in vertical direction.

2.5.4. ROLL and BLANK controls

When the instrument is **not** in the select mode (i.e. pushbutton SELECT released), the vertical cursor control is used as a roll function to provide paging through the entire 64-word memory.

The horizontal cursor control is used to blank channels.
In the Table modes blanking results in suppression columns from the left (i.e. channel 15) to the right (i.e. channel 0), see Fig. 2.6.
Recalling occurs by operating the horizontal cursor control in the reversed direction.

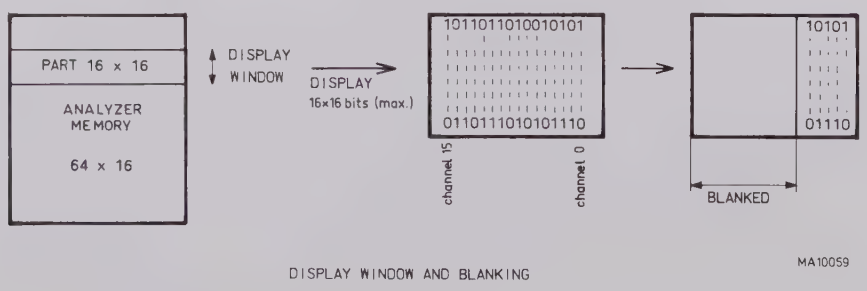


Fig. 2.6. Display window and blanking

2.5.5. Triggerword selection

After depressing the SELECT pushbutton the cursor appears in the heading of the display. The position of the cursor has to be adjusted to the triggerword position by using the horizontal or the vertical cursor control. When a triggerword is displayed in binary, the cursor can be positioned on one of the 16 digits and a "1", "0" or "X" (don't care) logic state is selected via pushbuttons 1/+, X and 0/—.
The cursor moves automatically to the next digit position. In octal or hexadecimal the horizontal cursor switch has to be used after selection via pushbuttons 1/+, X or 0/—.
The "+" pushbutton is used to reach the required 0 ... 7 or 0 ... F position. With the "—" pushbutton the sequence is 7 ... 0 or F ... 0.

2.5.6. Clock edge and Clock qualifier selection

After the SELECT pushbutton is depressed and the cursor is brought to the most top-left position of the screen the leading edge "1" or the trailing edge "0" can be selected via pushbuttons 1/+ and 0/—.
The next 3 positions on which the cursor is brought to, can be used for qualifying data acquisition. This means that data is only acquired when up to three additional logic conditions are fulfilled.
This can be done by selecting "1", "0" or "X" conditions, for the three qualifier inputs.

Note: If a clock qualifier is not connected, zero level is supplied.

2.5.7. START/STOP pushbutton

This is a one position control with two push functions:

- First push operation is the start function.
  This function initiates the moment at which the analyzer starts data capturing and recording.
- Second push operation stops capturing data .

The START/STOP control can be operated in AUTOmatic and SINGLE mode (see Fig. 2.7. and 2.8.).

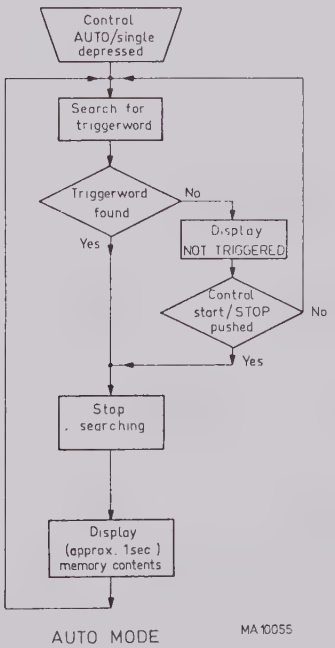


Fig. 2.7. Start/Stop operation in Auto mode

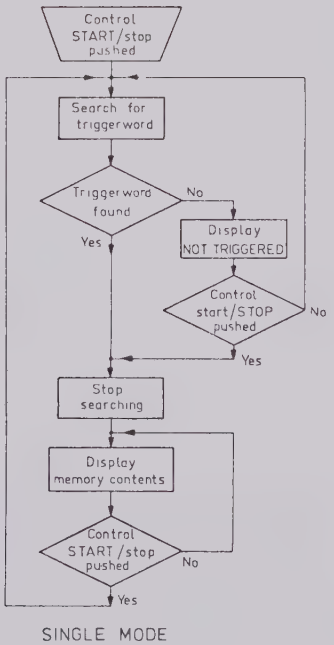


Fig. 2.8. Start/stop operation Single mode

2.5.8. AUTO/SINGLE mode

Data can be captured in two ways:

- AUTOmatically repeated sampling
- SINGLE sampling via manual START

In the AUTO mode (control depressed) sampling data occurs every second, which results in a continuous "refreshing" of the (input) memory contents and thus the displayed truth tables.
Automatic sampling is stopped when the AUTO/SINGLE control is set to the SINGLE position (see flow chart Fig. 2.7., START/STOP operation in the AUTO mode).

This mode is very useful when monitoring repetitive sequences, because individual bit changes can be defected easily.
In the SINGLE mode (control released) data input starts at a START operation and stops when the selected triggerword matches a data word in the data stream or after a STOP operation (see flow chart Fig. 2.8., START/STOP operation in the SINGLE mode). This means that the (input) memory is filled with data captured in one single sweep. The SINGLE mode provides a continuously displayed "snap shot" of the contents of the (input) memory. This feature is useful to analyze a specific part of the data stream.

2.5.9. STORE TRIGgerword pushbutton

The STORE TRIG pushbutton is a single position control which is effective after pressing.
When the STORE TRIG control is pressed, the 1st displayed word of the display window (see Fig. 2.5.) becomes the "new" selected trigger word and will also be displayed in the heading (see Fig. 2.5.).
The store facility for a "new" triggerword can be used to represent a fault condition.
For example, a fault condition in the data stream is displayed. This fault condition is shifted to the 1st word position by means of the ROLL control, after which it is stored as a "new" triggerword. The instrument then will trigger only when this particular fault occurs. This mode can be combined with trigger DELAY.

2.5.9.1. STORE TRIG in the AUTO mode

This mode is selected when the pushbuttons AUTO and STORE TRIG are depressed.
With this facility, paging can be extended beyond the captured data block. This means that after each STORE TRIG operation a new triggerword is selected and thus automatically a new data block with new information.
This mode can also be combined with trigger DELAY.

2.5.10. TRIGGER DELAY selection

After depressing the SELECT and DELAY pushbuttons and the cursor is brought to the delay position the delay parameter can be selected. The cursor has to positioned on each of the four digit positions, which are then set in a 0 ... 9 cycle using the "+" pushbutton or 9 ... 0 with the "—" pushbutton.
The trigger can be delayed by 0 ... 9999 clock pulses.
Trigger delay is switched off by re-pressing pushbutton DELAY.

2.5.11. COMPARE mode selection

With the pushbutton COMPARE depressed, a new recording is compared versus a previously stored good recording (see section 2.5.12. "Store reference"). A second 64 word memory is used to store reference data.
The captured data block of 64 words is compared with the reference data block.
Any inequality between the two block is indicated in the heading of the display by the message "UNEQ" and in the display format by intensified digits. In the HEX and OCT mode both the input and reference tables are displayed. In the BIN mode, only the data input table is shown. All bits in error are intensified e.g. an intensified 0 should be a 1 or vice versa.

Note: The appearance of "EQ" or "UNEQ" in the heading of the display, indicates whether the last array of 16x64 bits captured was or was not equal to the previously stored display.

2.5.11.1. COMPARE in the AUTO mode

This mode is selected when the pushbuttons COMPARE and AUTO are depressed.
Data is input and compared automatically.
This mode is very useful for data which might differ only incidentally.
As soon as any difference between the captured data and the reference data is detected data acquisition is stopped.
The inequality is indicated by the message "UNEQ" in the heading of the display and by a flashed character in the display.
If the inequality is not displayed, it can be brought on the screen with the aid of the ROLL control.

2.5.12. STORE REFerence

The instrument is in this mode, when the pushbutton COMPARE is depressed and the pushbutton STORE REF. is pressed.
New captured data is transferred from the input memory into the reference memory. The two blocks of data are compared on a bit-by-bit basis.

2.6. OSCILLOSCOPE MODE

In this mode, it is possible to use the PM 3540 as a general purpose dual-channel oscilloscope.
Due to the interactive relationship between the analyzer and the oscilloscope, it is possible to trigger both sides of the instrument from the same pre-selected triggerword.

2.7. SELECTION OFTHE OSCILLOSCOPE MODE

With pushbutton LSA/OSC in the released position, the oscilloscope mode is selected and all controls and sockets of the oscilloscope part of the PM 3540 are available for use.

2.7.1. Input coupling (AC/DC, 0)

AC coupling (pushbutton depressed) is useful to block the d.c. component of a signal. Choice of AC limits the lower frequencies, causing low repetition rate sinewave signals to be attenuated and low repetition rate square-waves to be distored. The degree of attenuation is determined by the input RC time (0.1 s). Input RC time is extended by 10 of 10:1 passive probes are employed.
When switching to AC coupling it will take approximately five input RC times before the trace is stabilised to the average value of the input signal.
AC position measurements cannot be made with respect to ground.

0 position disconnects input source and short-circuits input of amplifier to provide zero signal check.

DC coupling (pushbutton released) provides for full range frequency input, i.e. down to d.c.

2.7.2. Use of probes (see also section 3, "INFORMATION CONCERNING ACCESSORIES")

1:1 passive probes should be used for d.c. and low frequencies.
Capacitive loading attenuates high frequencies or increases the rise-time of measurement signals (dependent on source impedance).

10:1 passive probes have less capacitive loading, usually about 10 pF to 20 pF, FET probes are superior, especially when measurements are to be taken from high impedance test points or at the upper frequency limit of the logic-scope bandwidth.

10:1 passive probes must be properly compensated before use. Incorrect compensation leads to pulse distortion or amplitude errors at high frequencies.
For correct adjustment, the CAL output connection can be used (see Fig. 2.9.).

2.7.3. Adjustment of attenuator probes

- Connect the compensation box to the Y_A or Y_B input socket and place the tip of the probe on socket CAL.
- Insert a small screwdriver through the hole in the compensation box and adjust the trimmer to obtain a correct display as shown in Fig. 2.9.

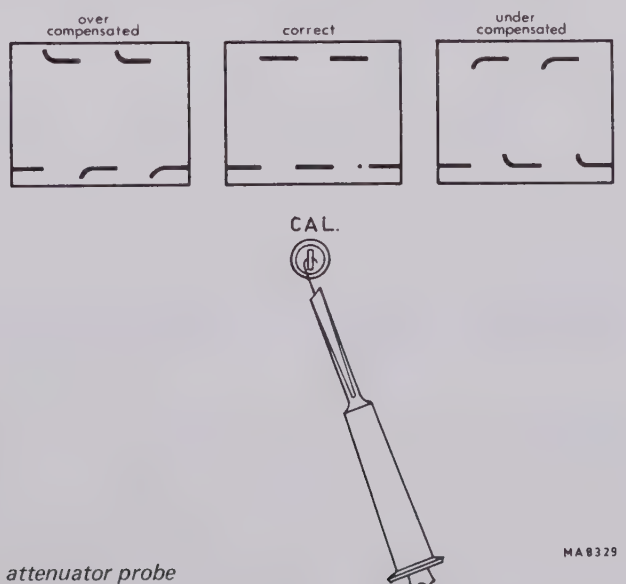


Fig. 2.9. Adjusting an attenuator probe

2.7.4. Selection of chopped or alternate modes

(A, ALT, CHOP, ADD, B)

In dual channel operations (CHOP or ALT depressed) the chopped mode (depress CHOP) must be selected for relatively slow sweep speeds (from .1 ms/div to .5 s/div) or at low repetition rates of sweeps occuring, even at high sweep rates. Selection of the ALTernate mode under these circumstances would make comparisons between waveforms difficult because traces would actually appear to be written one by one. However, when the display is fast enough to be interrupted by the chopping frequency the alternate mode must be selected (depress ALT), usually at sweep rates faster than .1 ms/div.

2.7.5. Differential mode

The A-B mode can be selected by depressing ADD and pulling the channel B POSITION control.
In measurements where signal lines carry substantial common mode signals (e.g. hum) the differential mode will cancel out these signals and leave the remainder of interest (A-B). The capability of the logic-scope to suppress common mode signals is given by the CMR factor (see Fig. 2.10.).
To obtain the degree of common mode rejection as specified, channel A and B gains must first be equalised. This can be done by connecting both channels to the CAL output connector, and adjusting one of the continuous controls with the AMPL/DIV switch for minimum deflection on the screen.
When passive 10:1 probes are used a similar equalisation process is recommended by adjusting their compensating controls for minimum deflection.

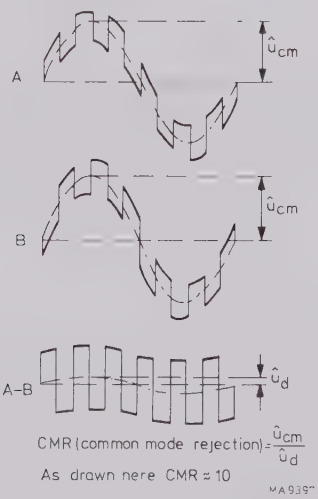


Fig. 2.10. Suppression of common mode signals

2.7.6. Trigger source selection

The trigger source is selected by the front-panel TRIG or X DEFL pushbuttons (S16).

A B EXT DATA
└COMP ┘ └ QUAL┘

- **Internal triggering** will be most commonly used because it requires only one signal (the Y_A or Y_B input signal) to obtain stable triggering.
- **External triggering.** When tracing many signals it is advantageous to use an external signal for triggering. There is no need to set and reset the trigger controls (LEVEL, SLOPE and SOURCE) on changing the input signal.
  Furthermore the two Y_A or Y_B inputs remain free for examining waveforms.
- **Selection of trigger source.** In comparing synchronous waveforms, that have unequal repetition rates, always select the signal, that has the lowest repetition rate as the trigger source. Not doing so may lead to double pictures (chopped mode) or untrue time-shifts (alternate mode).

– **Composite triggering.** With internal triggering signals are obtained from either the A channel, the B channel preamplifier stages or, when COMP is selected by depressing both A and B pushbuttons, from the delay line driver stage that follows the electronic channel switch.
Composite triggering offers three advantages:

1. In differential mode (A-B measurements) triggering is derived from the differential signal. Triggering is not disturbed by common mode signals.
2. For one channel operation it is not necessary to switch trigger sources from A to B or vice versa.
3. In the alternate mode, it is possible to compare signals that are not related in time.

Note: When composite triggering is employed in dual channel operation (alternate mode), and there is only one signal applied (to A or B input), stable triggering cannot be obtained. This is only normal since the trigger source is also switched from A to B (see Fig. 2.11.).
When composite triggering is employed in dual channel operation (chopped mode) stable triggering can not be obtained because the system will be triggered by the chopped signal transients.

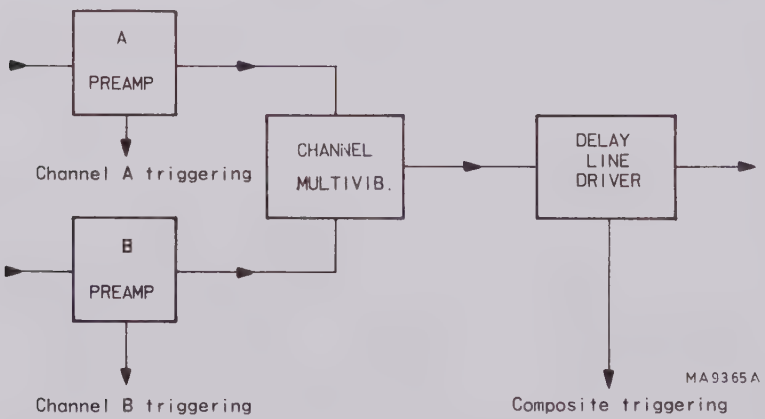


Fig. 2.11. Block diagram of composite trigger circuit

– **Data triggering.** By setting the trigger word to a known logic state that occurs just before a fault in the data stream arises, the oscilloscope's timebase can be triggered that the instrument only displays the real-time behaviour of two selected signals (input via Y_A and Y_B) just after the defined logic state occurs.
To do this, you must set the correct triggerword and run in oscilloscope mode with the DATA pushbutton depressed. You can then examine the detailed time-dependent behaviour of any two selected signals at the precise time when a fault is known to occur.

– **Qualifier triggering.** By operating with both DATA and EXT pushbuttons depressed i.e. the QUALifier mode, you can cause triggering to occur only when a triggerword match coincides with a "high" trigger qualifier logic level.
An unconnected trigger qualifier input is treated as permanently "high".

Note: When measurements in the DATA or QUALifier mode will be made, DC **and** + Slope positions of the trigger mode switch S_2 (see Fig. 2.2.) are strongly recommended.

2.7.7. Selection of trigger mode

(AUTO, AC, DC, TV, +/–)

The AUTO mode is most useful because it provides trace(s) on the screen even in the absence of trigger signals. Furthermore, for a signal amplitude larger than 1 division , this mode provides stable triggering independently of the position of the LEVEL control; its range is automatically adjusted to the peak-to-peak value of the signal selected for triggering.
In this way the setting of the LEVEL control is facilitated at small amplitudes of the trigger signal.
The AUTO mode cannot be employed for signals with low repetition rates (10 Hz or lower) because the sweeps would be able to free run in between triggers. Therefore, for low repetition signals normal triggering must be used (AC or DC depressed).
In normal triggering, sweeps are only initiated with a trigger signal applied and the LEVEL control set appropriately.
With AC or DC depressed the range of the LEVEL control is fixed (+ or – 8 divisions or more at the extremes of the LEVEL control with respect to mid screen).
The DC component in the trigger signal can be blocked by depressing AC. This is useful when triggering must take place on a.c. signals superimposed on a large d.c. level.
With AC coupling, the level at which the display starts will change with alterations in the average value of the trigger signal. The trigger level is thus no longer references to signal ground. This may cause instability with waveforms that vary in time interval from cycle to cycle. Normally it is preferable to use the DC position.
Slope selection is made with pushbutton +/–. In TV mode – must be selected for negative video signals and + for positive video signals. The LEVEL control is inoperable in the TV mode.
No buttons depressed offers an extra mode of use, a trace is on screen in the absence of a trigger signal, but the LEVEL range is fixed.

2.7.8. Time-base magnifier

The magnifier is operated by pulling the switch incorporated in the X position control.
When this switch is in the x10 position, the time-base sweep speed is increased 10 times. The sweep time is therefore determined by dividing the indicated TIME/DIV value by 10.

2.7.9. XY Measurements

XY measurements are made with the TIME/DIV switch at X DEFL, the source of horizontal deflection being selected by the EXT X DEFL or TRIG pushbutton switch (S16).
XY measurements provide a useful means of making frequency or phase shift comparisons by displaying Lissajous patterns.
Measurements can be made up to 100 kHz with less than 3^{o} phase error between oscilloscope channels.

The sensitivity for the different XY modes is shown in the following table:

X DEFL	SENSITIVITY
A	AMPL/DIV A ± 10 %
B	AMPL/DIV B ± 10 %
EXT	0.5 V/div
DATA	For this mode, not applicable.

2.8. PROCEDURES REQUIRED FOR THE REMOVAL OF FUSES, BEZEL AND CONTRAST PLATE

2.8.1. Removing the instrument covers

Always ensure that the mains supply is disconnected before removing any instrument cover plates.
The instrument is protected by three covers: a front panel protection cover, a wrap-around cover with carrying handle, and a rear panel.
To facilitate removal of the wrap-around cover and the rear panel, first ensure that the front cover is in position.

Then proceed as follows:

- Hinge the carrying handle clear of the front cover; to this end, push both pivot centre buttons (Fig. 2.12.)
- Stand the instrument on its protective front cover on a flat surface.
- Slacken the two coin-slot screws located on the rear panel.
- Lift the rear panel and unplug the connector on the power supply board.
- Lift off the wrap-around cover.
- For access to the front-panel, stand the instrument horizontally and snap off the front cover.

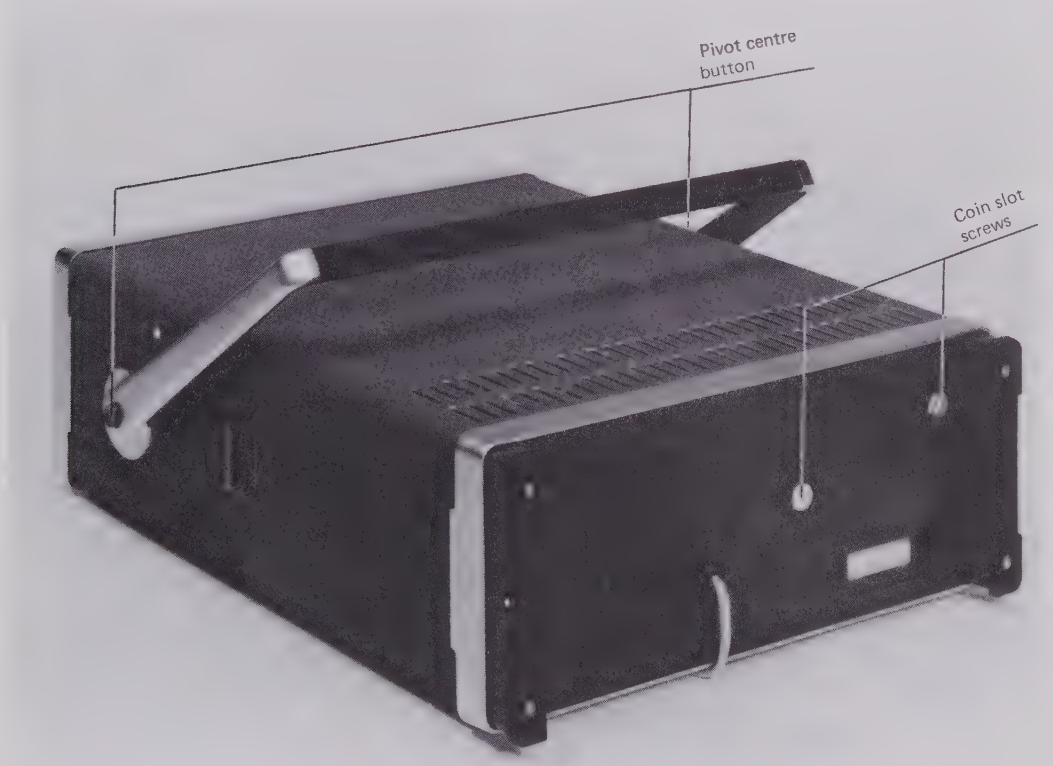


Fig. 2.12. Removing the instrument covers

2.8.2. Removing the mains transformer

- Remove wrap-around cover and rear panel (section 2.8.1.).
- Take the lid off the voltage adapter compartment after removing the 4 cross-slotted screws.
- Remove the 4 cross-slotted screws that hold the lid of the transformer compartment.
- Lift the lid with the attached transformer, simultaneously sliding the wire form between transformer and voltage adapter out of the slit in the transformer compartment.
- The transformer and thermal fuse are then accessible for replacement.

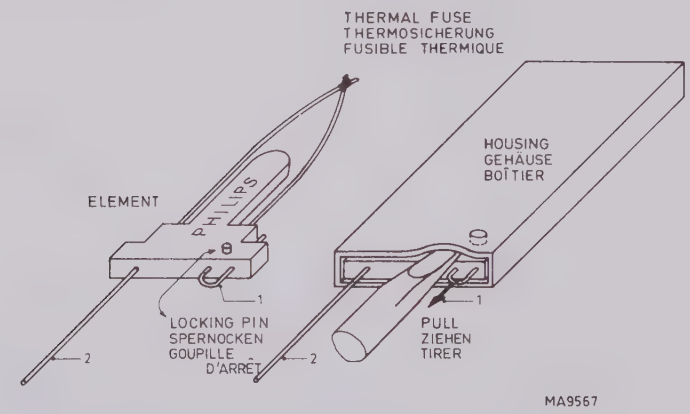


Fig. 2.13. Replacing the thermal fuse

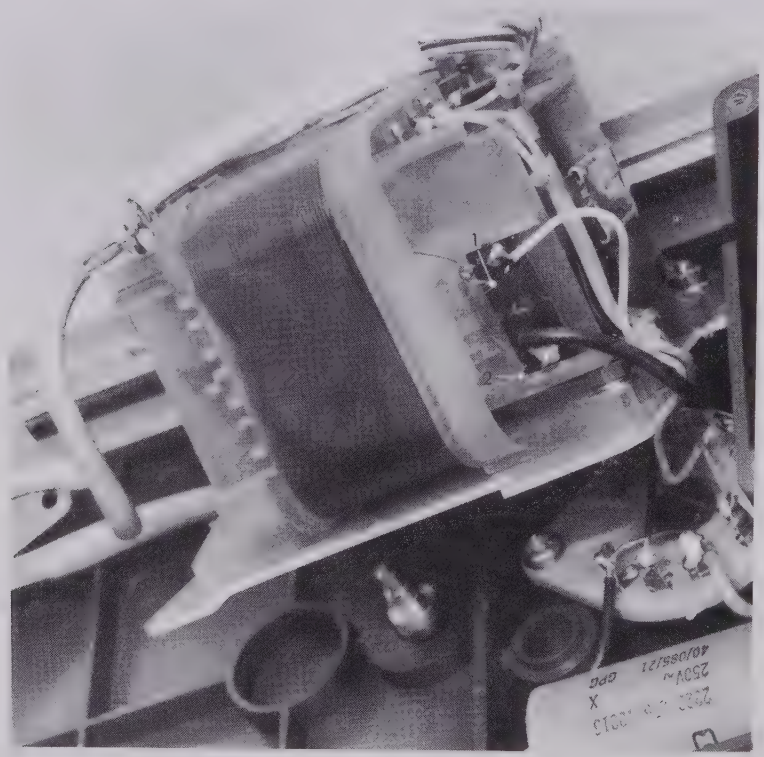


Fig. 2.14. Replacing the thermal fuse

2.8.3. Replacing the thermal fuse F101

- Remove the mains transformer (section 2.8.2.).
- Unsolder fuse terminals 1 and 2 (Fig. 2.13. and 2.14.).
- Only the fuse wire of the old fuse is replaced and not the complete fuse; to this end, bend the housing of the fuse slightly outwards, disengage the locking pin and pull out the wire.
- Take the new fuse and remove the fuse wire out of its housing in the same way as described above.
- Push the new fuse wire into the housing of the old one until the locking pin snaps into the hole. The loop in the fuse wire must point to terminal 1.
- Solder the fuse wire to terminals 1 and 2.

2.8.4. Replacing the fuse F201

- Remove wrap-around cover and rear panel (section 2.8.1.).
- Fuse F201, which is located on the power supply printed circuit board, is now accessible for replacement.

2.8.5. Removing the bezel and the contrast plate

- Take hold of the bezel's bottom corners and gently pull it from the front panel (Fig. 2.15.).
- The contrast filter can be removed by pressing it gently out of the bezel.

Fig. 2.15. Removing the bezel and the contrast plate

2.9. MAINTENANCE

This instrument generally requires no maintenance, as the instrument has no compartments that are subject to wear out. However, to ensure reliable and troublefree operation, the instrument should not be exposed to moisture, heat, corrosive elements or excessive dust.

The appearance of the wrap-around cover, lacquered with Mextel sued coating will deteriorate after some time. To clean it, use a soft cleansing pad with some ethanol or common household cleaning detergent. Abrasive cleaning pads or materials should not be used, otherwise surface scratches will result.

WARNING: The Mextel sued coating is ethanol-resistant, but is susceptible to methylated spirit, which will attack the surface (due to one of the de-naturing substances).

Cleaning the front and rear panels; do not use chemical solutions such as trichlorethylene or aceton.
Use a soft pad, cloth or cotton-wool with some water and common household cleansing or some alcohol or white spirit.

Check that after longer period of use, the holes in the cabinet plates don't get stopped up with dust. If necessary use pressurized air to free the holes.

Service data

3. Service Data

3.1. INFORMATION CONCERNING ACCESSORIES

3.1.1. Logic Pod PM 8820 (analyzer probe)

The PM 8820 is a compact 8 bit Logic Pod for use with, for example the Logic-scope PM 3540.
It contains 8 identical high speed level detectors, with a common wide-range threshold, featuring high input impedances and TTL compatible outputs. Power should be obtained from the instrument it is used with.

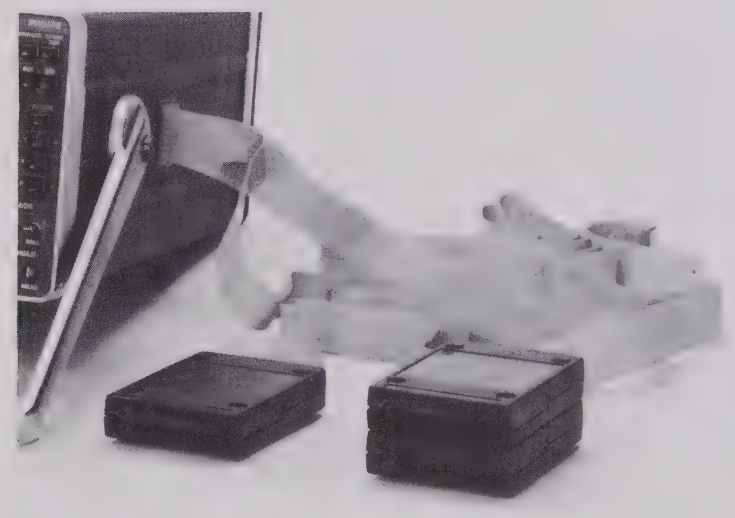


Fig. 3.1. Logic Pod PM 8820

3.1.1.1. General

Unless otherwise stated, the chracteristics listed, apply for the PM 8820 only; i.e. excluding the effect of the logic-scope.
The properties expressed in numerical values with tolerances stated, are guaranteed by the manufacturer.
Numerical values without tolerances are typical and represent the characteristics of an average instrument.
All characteristics are valid after a warming up period of 15 minutes.

3.1.1.2. Electrical characteristics

Designation		*Specification*		*Additional information*
Maximum ratings:				No damage to the PM 8820
Supply voltages:		Min.	Max.	
	U_p	0 V	+ 6 V	All tensions with respect to common ground (⊥)
	U_n	0 V	+15 V	
	U_{pp}	− 6 V	0 V	
	U_{nn}	−15 V	0 V	
Reference voltage (U_{REF})		−50 V	+50 V	
Input voltages (at DI_0 to DI_7)		−50 V	+50 V	
Power:				To be supplied by Logic-scope (or other instrument the PM 8820 is used with).
Voltage:	U_p	+ 5 ± 0,25 V		
	U_{pp}	− 5 ± 0,25 V		
	U_n	+12 ± 0,6 V		
	U_{nn}	−12 ± 0,6 V		

Current:	Min.	Typical	Max.
drain from U_p		+110 mA	+200 mA
drain from U_n	−110 mA	− 62 mA	
drain from U_{pp}		+ 16 mA	+ 25 mA
drain from U_{nn}	− 25 mA	− 16 mA	

Input:			DI_0 to DI_7
Voltage range:		⩽ −6 V to ⩾ 18 V	
Impedance:	R_p static	4,7 ± 0,1 MΩ	Test leads excluded
	R_p dynamic	See curve Fig. 3.2.	Input voltage within range, otherwise input impedance slightly lower.
	C_p	6 ± 1 pF	
Bias Current		0,5 μA	
Min. slew-rate		1 V/μs	
Max. frequency		20 MHz	
Min. pulse duration		20 ns	

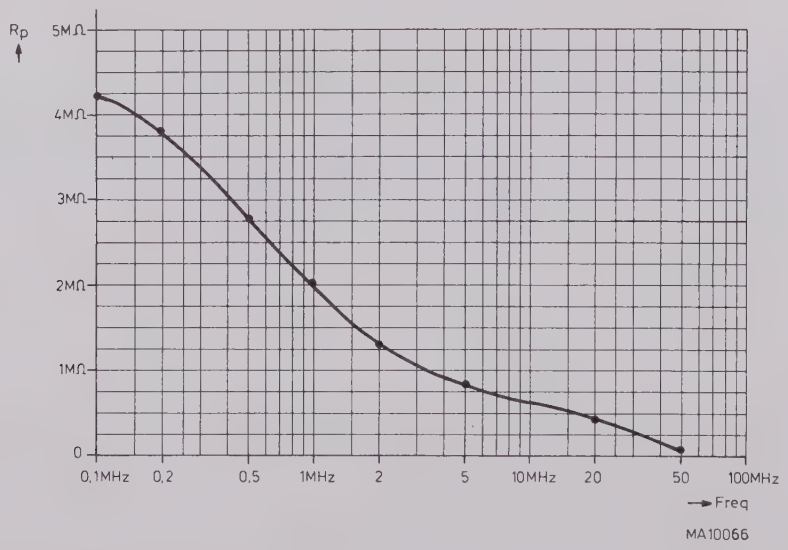


Fig. 3.2. Input resistance (R_p) versus frequency

Designation		*Specification*	*Additional information*
Output			DO_0 to DO_7
Logic:	$U_{D.out}$ = "LOW"	if $U_{D.in} < U_{Threshold}$	(DO_0 responds to DI_0 and
	$U_{D.out}$ = "HIGH"	if $U_{D.in} > U_{Threshold}$	DO_1 to DI_1 etc.)
Voltage:	"LOW"	$\leqslant$ 0,5 V	I_{Load} = +2 mA
	"HIGH"	$\geqslant$ 2,5 V	I_{Load} = −1 mA
Threshold			
Threshold level ($U_{Thr.}$)		U_{Ref} ± 20 % −50 mV	U_{DO} = "LOW"
Reference range (U_{Ref})		$\leqslant$ −3 V to $\geqslant$ +12 V	
Threshold hysteresis		+60 mV	Static decrement of threshold when U_{DO} = "HIGH"
Input resistance of U_{Ref} input		650 kΩ	
Bias current U_{Ref} input		3,5 μA	
Propagation delay			Measured with 1 ns t_r of input pulse and U_{Thr} = $\frac{U_{D.in}\text{ "LOW"} + U_{D.in}\text{ "HIGH"}}{2}$
LOW → HIGH transition		23 ± 3 ns	Response time measured from (U_{Thr} +0,2 V) point of input to 2 V point of output) See Fig. 3.3.
HIGH → LOW transition		24 ± 3 ns	Response time measured from ($U_{Thr.}$ −0,2 V) point of input to 0,8 V point of output) See Fig. 3.3.

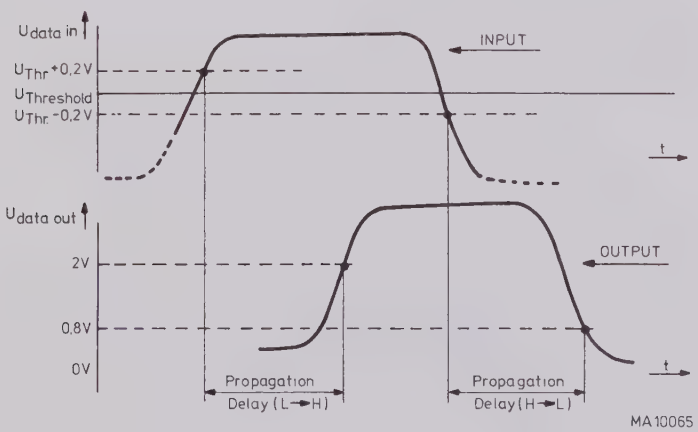


Fig. 3.3. Definition of Programation delay

3.1.1.3. Mechanical characteristics

Designation		*Specification*	*Additional information*
Dimensions			
Pod-body:	length	120 mm	feet included
	width	65 mm	
	height	22 mm	
Pod-cable:	length	1450 mm	
	width	25 mm	
Test-lead:	length	265 mm	
Test hook:	length	48 mm	
	diameter	7,5 mm	max.

Accessories supplied with PM 8820:

Test leads	9 Colour coded	See Fig. 3.4.
Test hooks	9	
Blank stickers	4	
Pouch	1	

Optional accessories (not supplied with PM 8820)	PM 8819	Contains: 1 eight pins interface connector 9 test leads 9 test hooks 4 blank stickers
	PM 8810	Trigger extension po

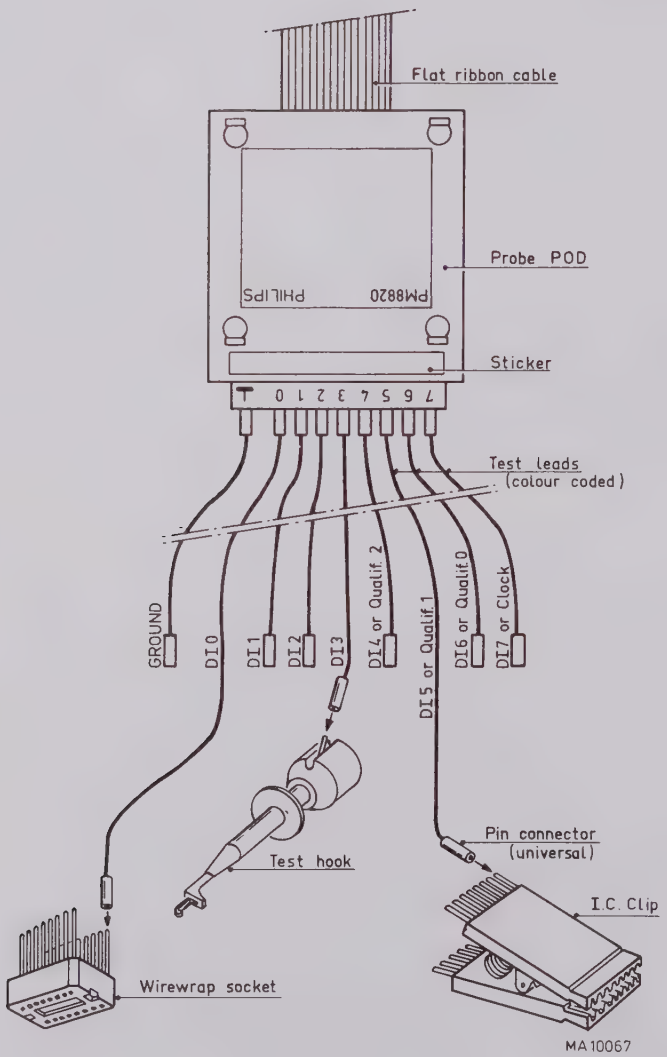


Fig. 3.4. Probing with Pod PM 8820

3.1.1.4. Environmental characteristics

Designation	*Specification*	*Additional information*
Ambient temperature		
Rated range of use Limits of operation Storage and transport conditions	+ 5 °C to +40 °C –10 °C to +55 °C –40 °C to +70 °C	Test procedure conforming to IEC 68, Ab & Bb
Recovery time	1 hour	If temperature of PM 8820 is raised from –40 °C to +20 °C at 60 % relative humidity
Humidity	Probe withstands 21 cycles of damp heat test: temp. 25 °C to 45 °C, Rel. humidity 90 % to 100 %. Cycle duration 24 hours.	Test procedure conforming to IEC 68 Db
Altitude		
Limit of operation Limit of transport	5000 m (in open air) 15000 m (in open air)	Is 475 mbar or 47,5 kPa Is 100 mbar or 10,0 kPa
Bump	PM 8820 withstands 1000 bumps of 100 m/s^2, 1/2 sine, 6 ms duration in each of 3 directions	In accordance with IEC 68 FC
Vibration	PM 8820 withstands in each of 3 directions, 30 min. vibration of 10-150 Hz, 0,7 mm peak to peak amplitude or 50 m/s^2 acceleration.	In accordance with IEC 68 Eb

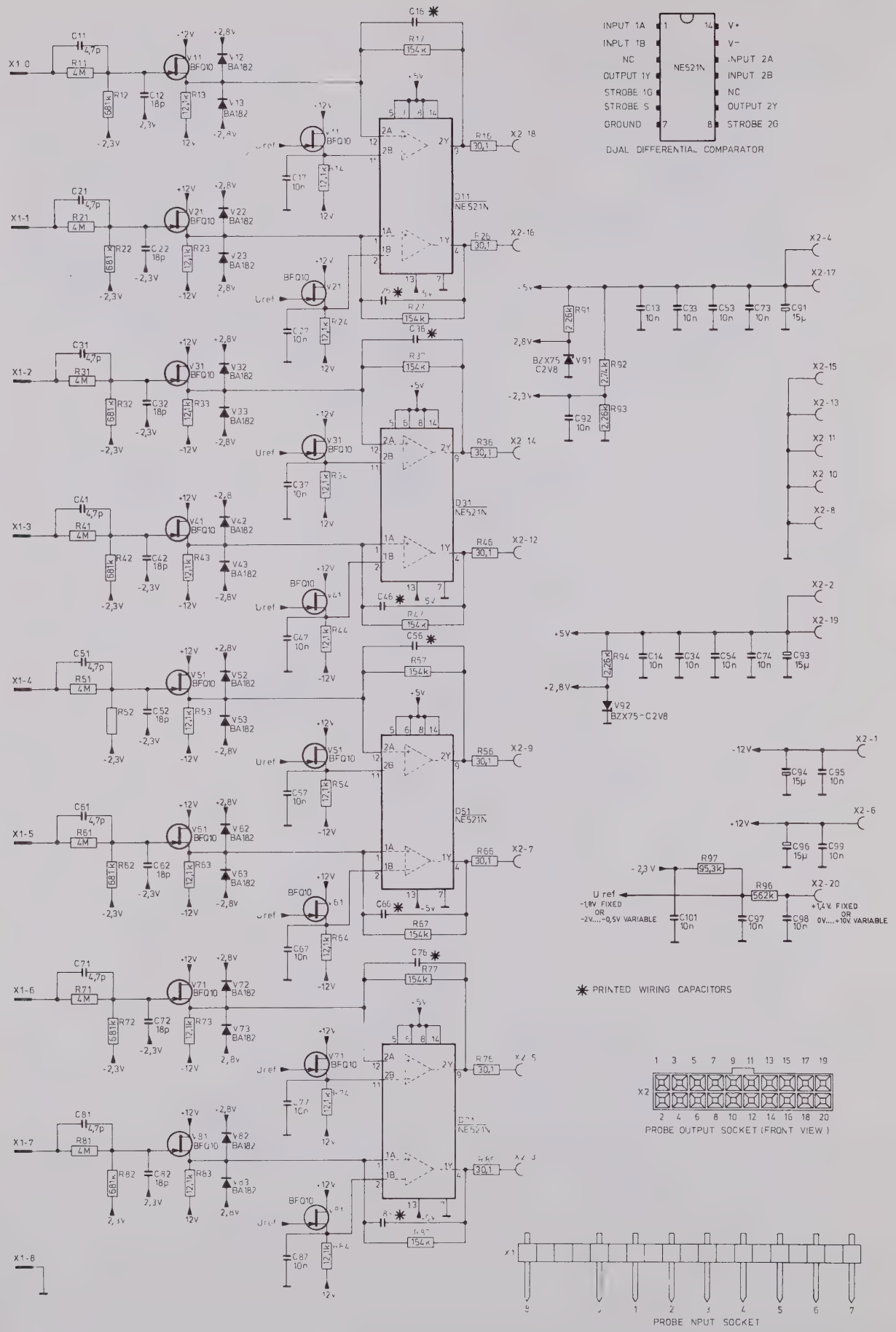


Fig. 3.5. Circuit diagram of the PM 8820 probe Pod.

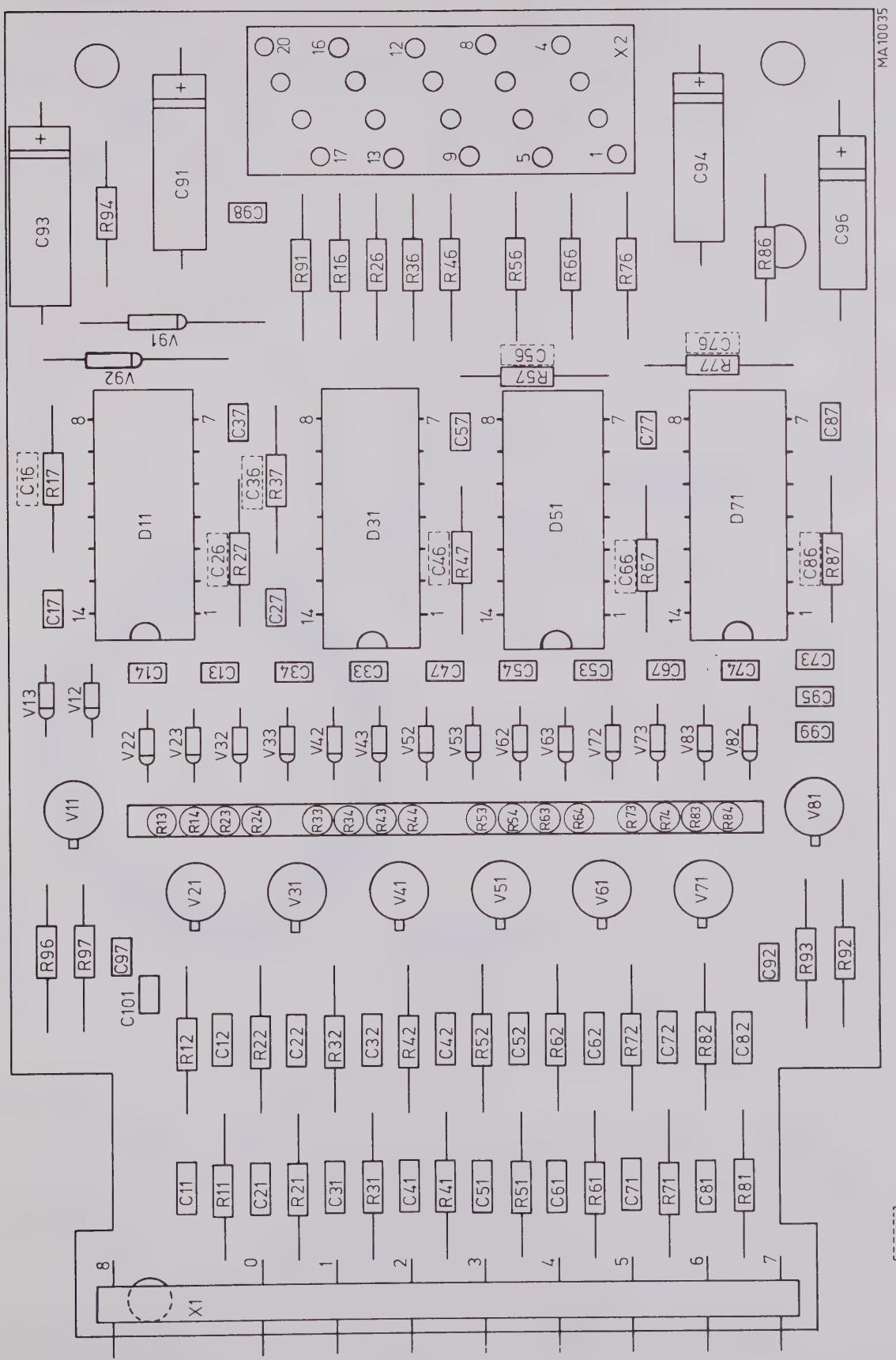


Fig. 3.6. Printed circuit board of the PM 8820 probe Pod

3.1.2. 1:10 Attenuator probe sets PM 9336 and PM 9336L (oscilloscope probe)

The PM 9336 is a 10x attenuator probe, designed for oscilloscopes up to 25 MHz, having a BNC input jack and 10 to 35 pF input capacitance, paralleled by 1 MΩ. The PM 9336L is a similar probe with a cable length of 2,5 m.

The set consists of:

1 probe assembly	Fig. 3.7. item 1
5 soldering terminals	Fig. 3.7. item 2
1 test hook	Fig. 3.7. item 3
2 spare test hook sleeves	Fig. 3.7. item 4
1 protective cap	Fig. 3.7. item 5
1 probe holder	Fig. 3.7. item 6
2 probe tips	Fig. 3.7. item 7
1 earthing cord	Fig. 3.7. item 8
1 box	

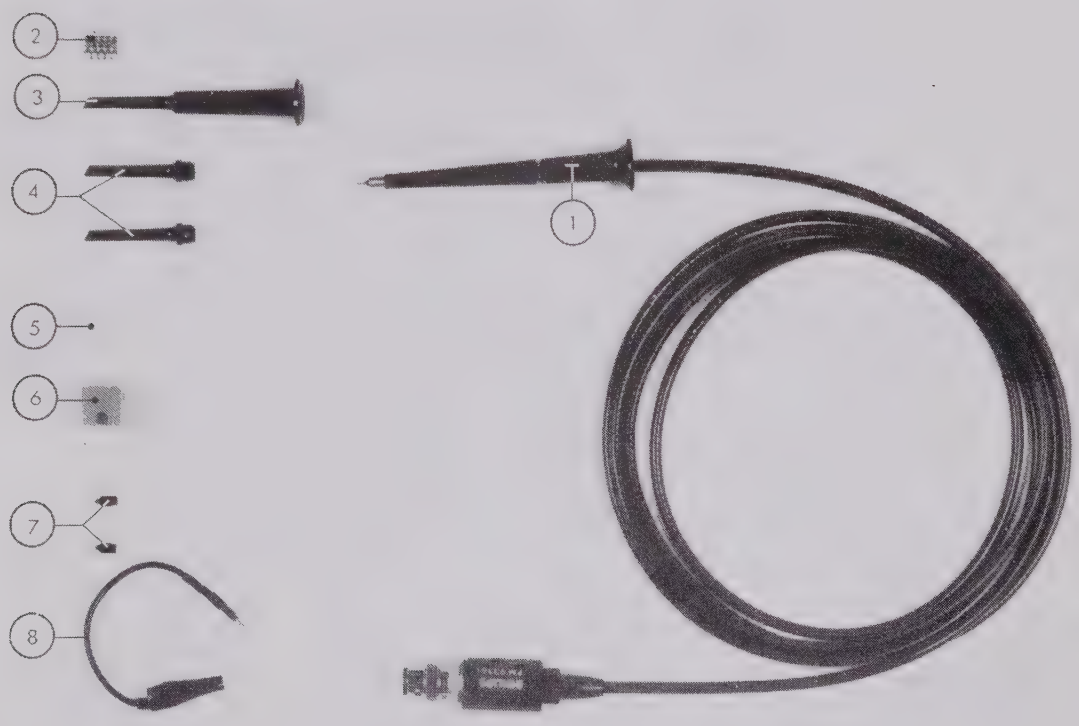


Fig. 3.7. Attenuator probe set PM 9336 (PM 9336L)

3.1.2.1. Technical data

Attenuation	1:10 ± 3 %		
Input resistance	PM 9336	10 MOhm	± 2 %
	PM 9336L	10 MOhm	± 2 %
Input capacitance	PM 9336	11 pF	± 1 pF
	PM 9336L	14 pF	± 1 pF
Maximum allowable input voltage	500 V (D.C. + A.C. peak).		

3.1.2.2. Adjustment

The measuring probe has been adjusted and checked by the factory. However, to match the probe to your instrument, the following manupulation is necessary.
Connect the measuring pin to socket CAL of the instrument.
A trimmer can be adjusted through a hole in the compensation box to obtain optimum square-wave response.

See the following examples.

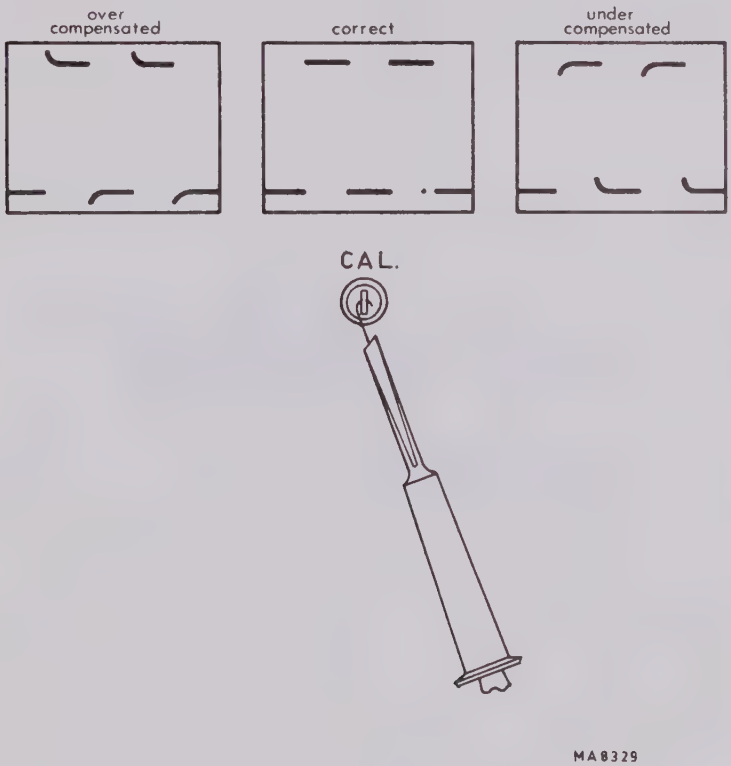


Fig. 3.8. Probe compensation

3.1.2.3. Parts of attenuator probe sets PM 9336 and PM 9336L

Item	*Qty.*	*Ordering code*	*Description*
1	1	5322 320 14004	Cable assembly PM 9336 (1,5 m)
1	1	5322 320 14013	Cable assembly PM 9336L (2,5 m)
2	1	5322 255 44026	Soldering terminal
3	1	5322 264 20024	Test hook
4	1	5322 264 20028	Test hook sleeve
5	1	5322 532 60535	Protective cap
6	1	5322 256 94034	Probe holder
7	1	5322 268 14017	Probe tip
8	1	5322 321 20223	Earthing cord
9	1	5322 600 34002	Box

3.1.3. **1:1 Probe sets PM 9335 and PM 9335L** (oscilloscope probe)

The PM 9335 is a passive probe without signal attenuation for use with oscilloscope, counters and voltmeters having a high input impedance and a BNC input socket.
The cable design is such that the reflections due to the instrument's capacitive load are absorbed.
The useful range of this probe is restricted to d.c. and l.f. applications (up to 10 MHz).
The PM 9335L is a similar probe with a cable length of 2,5 m.

The set consists of:

1 test hook	Fig. 3.9. item 1
2 spare test hook sleeves	Fig. 3.9. item 2
2 spare probe tips	Fig. 3.9. item 3
1 protective cap	Fig. 3.9. item 4
1 earthing lead	Fig. 3.9. item 5
1 probe holder	Fig. 3.9. item 6
1 probe assembly	Fig. 3.9. item 7
1 box	

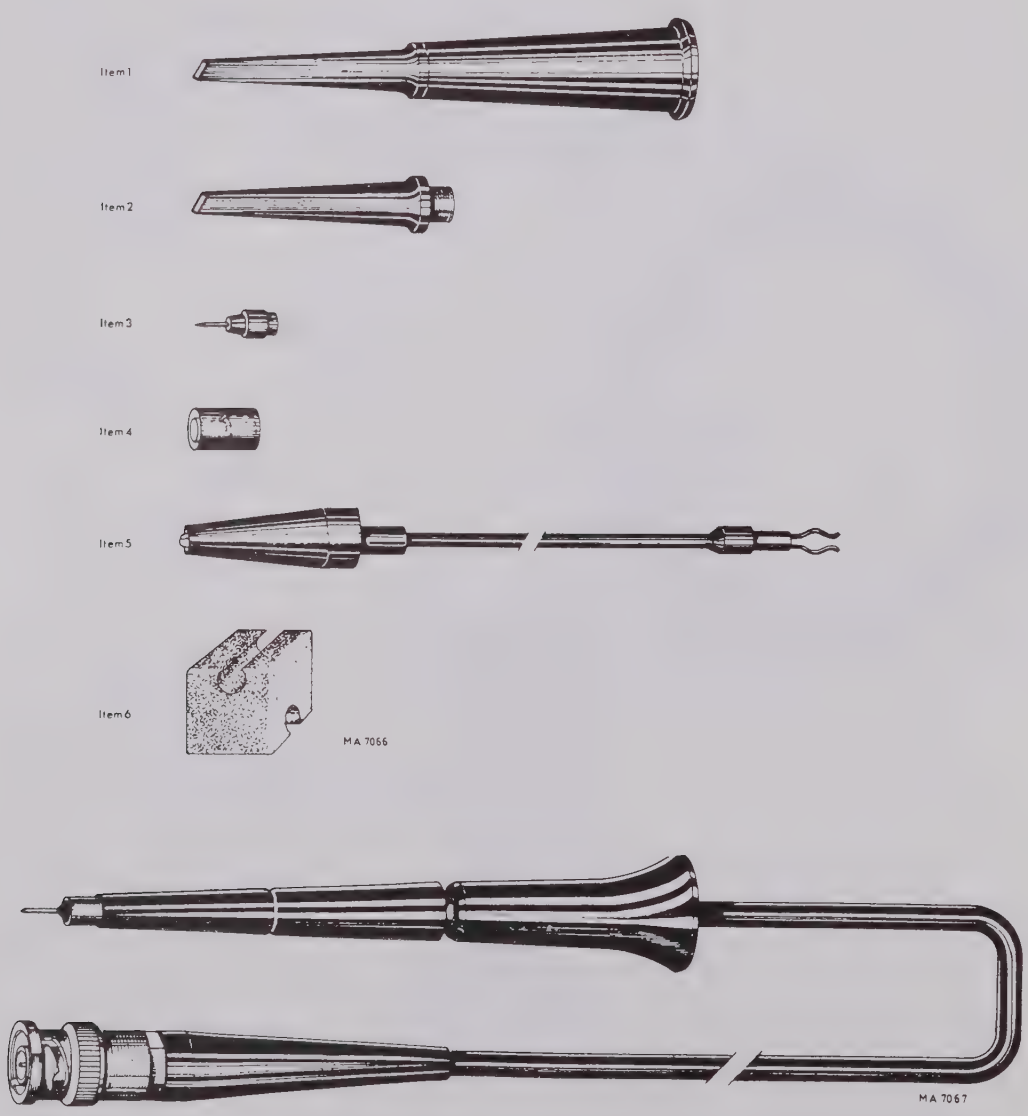


Fig. 3.9. Probe set PM 9335 (PM 9335L)

3.1.3.1. Technical data

Attenuation	1:1
Input resistance	1 MOhm
Input capacitance	45 ± 5 pF + input cap. of measuring instrument

Max. allowable input voltage

D.C.	500 V
A.C. peak-to-peak	500 V derating at higher frequencies with $\frac{500\ V}{MHz}$
A.C. peak + D.C.	500 V

Dimensions	*L*	*W*	*H*	
Probe body	105			mm
Cable	1.5			m
Box	230	104	24	mm

3.1.3.2. Parts of probe set PM 9335

Item	*Qty.*	*Ordering code*	*Description*
1	1	5322 264 20024	Test-hook
2	1	5322 264 20028	Test-hook sleeve
3	1	5322 268 14017	Probe tip
4	1	5322 532 60535	Protective cap
5	1	5322 321 20223	Earth lead
6	1	5322 265 94034	Probe holder
7	1	5322 320 14005	Probe assembly
	1	5322 600 34002	Box

3.2. PARTS LISTS

	Ordering number	Type/Description
Semi conductors		
	5322 131 24029	D14-125GH/08
	5322 130 30259	BY127
	5322 130 30259	BY127
	5322 130 30259	BY127
	5322 130 30259	BY127
	5322 130 34304	BYX49-300
	5322 130 44235	BD237
	5322 130 30613	BAW62
	5322 130 34173	BZX79-C5V6
	5322 130 30765	BZX75-C3V6
	5322 130 30765	BZX75-C3V6
	5322 130 30613	BAW62
	5322 130 44196	BC548C
	5322 130 44197	BC558B
	5322 130 44235	BD237
	5322 130 44235	BD237
	5322 130 30613	BAW62
	5322 130 30613	BAW62
	5322 130 30613	BAW62
	5322 130 30613	BAW62
	5322 130 30613	BAW62
	5322 130 34594	BY409
	5322 130 34594	BY409
	5322 130 34594	BY409
	5322 130 34594	BY409
	5322 130 34594	BY409
	5322 130 34594	BY409
	5322 130 34671	BZX61-C110
	4822 130 30839	BY206
	4822 130 30839	BY206
	5322 130 30613	BAW62
	5322 130 30424	BAX12
	5322 130 30424	BAX12
	5322 130 30424	BAX12
	5322 130 30424	BAX12
	5322 130 30424	BAX12
	5322 130 30424	BAX12
	5322 130 30613	BAW62
	4822 130 30839	BY206
	5322 130 44237	BF450
	5322 130 44237	BF450
	5322 130 44196	BC548C
	5322 130 30613	BAW62
	5322 130 34037	BAV45
	5322 130 44548	ON561
	5322 130 44154	BF199
	5322 130 44154	BF199
	5322 130 44154	BF199
	5322 130 44237	BF450
	5322 130 44237	BF450
	5322 130 44237	BF450
	5322 130 44237	BF450
	5322 130 44197	BC558B
	5322 130 44197	BC558B
	5322 130 44196	BC548C
	5322 130 44196	BC548C

Ordering number	Type/Description
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44197	BC558B
5322 130 34037	BAV45
5322 130 44548	ON561
5322 130 44154	BF199
5322 130 44154	BF199
5322 130 44237	BF450
5322 130 44237	BF450
5322 130 44237	BF450
5322 130 44237	BF450
5322 130 44197	BC558B
5322 130 44197	BC558B
5322 130 44197	BC558B
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44197	BC558B
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44154	BF199
5322 130 44154	BF199
5322 130 44154	BF199
5322 130 44154	BF199
5322 130 44196	BC548C
5322 130 30191	QA95
5322 130 30191	QA95
5322 130 30613	BAW62
5322 130 44196	BC548C
5322 130 44548	ON561
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44237	BF450
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44197	BC558B
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62

Ordering number	Type/Description
5322 130 44197	BC558B
5322 130 40417	BSX20
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44154	BF199
5322 130 44154	BF199
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 34233	BZX79-C5V1
5322 130 44603	BFT45
5322 130 44108	BF338
5322 130 40417	BSX20
5322 130 30613	BAW62
5322 130 44237	BF450
5322 130 44603	BFT45
5322 130 44108	BF338
5322 130 34233	BZX79-C5V1
5322 130 34098	BZX79-C36
5322 130 34098	BZX79-C36
5322 130 34098	BZX79-C36
5322 130 34442	BZX79-C75
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 30191	QA95
5322 130 44196	BC548C
5322 130 30613	BAW62
5322 130 30613	BAW62
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44247	BSS68
4822 130 30842	BAV21
4822 130 30842	BAV21
5322 130 44196	BC548C
5322 130 44197	BC558B
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 44196	BC548C
5322 130 30613	BAW62

Integrated circuits

Ordering number	Type/Description
5322 209 84862	SG3823N
5322 209 84862	SG3823N
5322 209 84111	CA3086
5322 209 84111	CA3086
5322 209 85201	N74LS132A
5322 209 84167	N74S00A
5322 209 84954	N74S10A

Miscellaneous

5322 130 34595	LED CQY24A-I
5322 134 44177	Lamp 28 V 80 mA
5322 134 44177	Lamp 28 V 80 mA
4822 253 30023	Fuse 1,4 A
4822 280 20064	Sam reed relais
4822 280 20064	Sam reed relais
4822 280 20064	Sam reed relais
5322 281 64154	Coil
5322 281 64154	Coil
5322 281 64154	Coil
5322 156 14074	Coil
5322 156 14074	Coil
5322 150 14015	Rotary coil
5322 320 44029	Delay line unit
5322 105 34034	Attenuator switch
5322 105 34035	Time base switch
4822 266 30071	3-pole plug
4822 265 30121	3-pole socket
4822 266 30072	4-pole plug
4822 265 30119	4-pole socket
4822 266 30073	6-pole plug
4822 265 30117	6-pole socket
4822 266 40057	7-pole plug
4822 265 40119	7-pole socket

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS

(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① Country	② Day Month Year	③ Typenumber /Version	④ Factory/Serial no.
32	150475	0PM3260 02	DO 0078 3

CODED FAILURE DESCRIPTION ⑥

⑤ Nature of call	Location	Component/sequence no.	Category
☐ Installation		TS0607	5
☐ Pre sale repair		R00631	2
☐ Preventive maintenance	0021	990001	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ 12 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 32 = Switzerland

②Day Month Year 150475 = 15 April 1975

③Type number/Version OPM3260 02 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number DO0783 = DO 783 These data are mentioned on the type plate of the instrument

⑤ Nature of call: Enter a cross in the relevant box

⑥ Coded failure description

Location

☐☐☐☐

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

☐☐☐☐☐☐

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric, the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

990000 Unknown/Not applicable
990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002 Knob (incl. dial knob, cap, etc.)
990003 Probe (only if attached to instrument)
990004 Leads and associated plugs
990005 Holder (valve, transistor, fuse, board, etc.)
990006 Complete unit (p.w. board, h.t. unit, etc.)
990007 Accessory (only those without type number)
990008 Documentation (manual, supplement, etc.)
990009 Foreign object
990099 Miscellaneous

Category

☐

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement (of transistor, resistor, etc.)
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

⑦ Job completed: Enter a cross when the job has been completed.

⑧ Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

☐☐12 = 1,2 working hours (1 h 12 min.)

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